U.S. Army
Environmental
Center

# FORT DIX
# REMEDIAL INVESTIGATION/FEASIBILITY STUDY
# FOR MAG-1 AREA

## FINAL
## QUALITY ASSURANCE PROJECT PLAN
## DATA ITEM A005

**CONTRACT DAAA15-91-D-0008**
**TASK ORDER 0007**

**U.S. ARMY ENVIRONMENTAL CENTER**
**ABERDEEN PROVING GROUND, MARYLAND**

20070424331

**JANUARY 1994**

***PRINTED ON RECYCLED PAPER***

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AEC Form 45, 1 Feb 93 replaces THAMA Form 45 which is obsolete.

# REMEDIAL INVESTIGATION/FEASIBILITY STUDY
# FORT DIX U.S. ARMY INSTALLATION
# FORT DIX, NEW JERSEY

MAG-1 AREA
FINAL QUALITY ASSURANCE PROJECT PLAN
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CONTRACT NUMBER DAAA15-91-D-0008
TASK ORDER NO. 0007

*Prepared for*

U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland

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Project No. 7134-03

JANUARY 1994

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

TABLE OF CONTENTS

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

**TABLE OF CONTENTS**
(continued)

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

## TABLE OF CONTENTS
(continued)

## QUALITY ASSURANCE PROJECT PLAN
## FORT DIX RI/FS MAG-1 AREA

## TABLE OF CONTENTS
(continued)

## LIST OF FIGURES

## LIST OF TABLES

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

## LIST OF TABLES
(continued)

# 1.0 INTRODUCTION

The United States Army Environmental Center[1] (USAEC) has tasked ABB Environmental Services, Inc. (ABB-ES) to perform a Remedial Investigation/ Feasibility Study (RI/FS) for the Magazine Area 1 (MAG-1) at Fort Dix U.S. Army Installation (Ft. Dix), located in central New Jersey. This work is being conducted to determine the nature and approximate extent of contamination at the MAG-1 Area and to assemble and evaluate remedial alternatives for the MAG-1 Area. For the purposes of this report the use of the term extent in defining site contamination is intended to indicate the approximate distribution of contamination. The precise nature and extent of contamination will not be defined. Rather, the nature and extent of contamination will be estimated from individual soil, groundwater, surface water, and sediment samples. Work for this assignment will be performed under Contract No. DAAA15-91-D-0008, Task Order 0007.

This Quality Assurance Project Plan (QAPP) delineates the purpose, policies, Standard Operating Procedures, (SOPs), and organization of the quality assurance program which will be used to establish the integrity of Ft. Dix project activities. The procedures detailed in this QAPP are in compliance with the U.S. Environmental Protection Agency (USEPA) Region II <u>Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Quality Assurance Manual</u>, October, 1989 (USEPA QAM), and with the USATHAMA Installation Restoration Quality Assurance Program, 1990. In cases where the above-listed guidance documents are in conflict, the more stringent method was selected. Therefore, the procedures in this QAPP meet or exceed USEPA QAM requirements.

This QAPP is divided into thirteen sections. Project description, field operations, organization, and responsibilities are delineated in Sections 2.0 and 3.0. Responsibilities for field and laboratory activities are provided as well as a list of key individuals. Section 4.0 defines the data quality objectives for the MAG-1 Area RI/FS. Sampling protocols and calibration procedures are delineated in Sections 5.0 and 6.0, including sample custody, collection, management, laboratory preparation, and analytical procedures. Section 7.0 defines data management while system

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[1]In January 1993 the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) became the U.S. Army Environmental Center (USAEC). Throughout the Work Plans "USATHAMA" will be used in reference to previous reports etc. which predate this name change.

controls for laboratory data quality are listed in Section 8.0. Section 9.0 discusses preventive maintenance. Sampling and laboratory recordkeeping are delineated in Section 10.0. Additional quality control measures are defined in Sections 11.0 through 13.0, and include system and performance audits, corrective action, and quality control reports.

## 1.1 PURPOSE

Quality Assurance (QA) is defined as the overall system of activities for assuring the reliability of data produced. The system integrates the quality planning, assessment, and improvement efforts of various groups in the organization to provide the independent QA program necessary to establish and maintain an effective system for collection and analysis of environmental samples and related activities. The program encompasses the generation of valid and complete data and its subsequent review, validation, and documentation.

## 1.2 SCOPE

This QAPP establishes function-specific responsibilities and authorities for data quality and defines procedures which will ensure that field and laboratory activities will result in the generation of quality data. Implementation of the QAPP will help to ensure the validity of data collected, and will establish a firm foundation for decisions regarding remedial actions at the MAG-1 Area.

Inherent in the QA program is the implementation of Quality Control (QC) measures. These measures provide assurance that the monitoring of quality-related events has occurred, and that data gathered in support of the project is accurate, precise, representative of the sample matrix, and complete.

# 2.0 PROJECT DESCRIPTION

## 2.1 PROJECT SCOPE

The scope of this task is to conduct an RI/FS at the MAG-1 Area at Ft. Dix. At the MAG-1 Area, investigative techniques were selected to address specific concerns identified in the 1993, Phase II RI Report (Dames and Moore, 1993). This investigation will include: surface and borehole geophysics consisting of ground penetrating radar (GPR) and natural gamma logging; a soil sampling program that includes up to 14 soil borings and three test pits; a groundwater program that includes up to 18 screened auger borings, 13 monitoring wells and six piezometers; and a surface water/sediment sampling program that includes sampling at 15 locations as well as wetland boundary delineation.

The results of the field sampling operations will be used to characterize the MAG-1 Area and identify potential environmental contamination. This characterization will be used later to develop a FS for the MAG-1 Area which presents recommendations on the best methods for remediation.

## 2.2 PROJECT OBJECTIVE

The primary objective of this task is to adequately characterize the nature and distribution of contamination associated with the MAG-1 Area so that a remedial action (if necessary) be completed.

## 2.3 SITE BACKGROUND

The U.S. Army Training Center and Ft. Dix is comprised of 32,605 acres located in Burlington and Ocean Counties, New Jersey. Ft. Dix is located 16 miles southeast of Trenton, New Jersey and 32 miles northeast of Philadelphia, Pennsylvania. Figure 2-1 is a site location map.

Ft. Dix was established as Camp Dix in an area of farmland and forest in 1917. It was a cantonment area and training post for troops who would fight in World War I. It served the Army in several capacities after the war until 1933. From 1933 until

1939, the post served as a reception, discharge, and replacement center for the Civilian Conservation Corps (CCC).

Camp Dix became a permanent Army installation in 1939, and its name was changed to Ft. Dix. Ft. Dix served as a reception and training center during World War II. Ft. Dix was the home to two divisions, the 9th Division from 1947 to 1954 and the 69th Division from 1965 to 1967. Ft. Dix is now a government-owned installation under the jurisdiction of the U.S. Army Training and Doctrine Command (TRADOC). Its mission is to conduct Basic Combat Training and Advanced Individual Training, and to provide Combat Support and support to Reserve and National Guard Units. In October 1992, the major command was shifted to Forces Command (FORSCOM).

The MAG-1 Area is located in the northwestern part of the Cantonment Area of Ft. Dix. A review of historic blueprints of the area indicates that the MAG-1 Area existed as early as 1917, along the south side of a Penn Atlantic Railroad spur (Dames and Moore, 1993). Between 1942 and 1965 the MAG-1 Area was the site of an ammunition and weapons magazine storage area and a vapor degreasing operation, where cosmoline was removed from rifles. Waste trichloroethylene (TCE), used in the degreasing operation, and cosmoline were dumped in a rubble pile at the MAG-1 site. Typically, one 55-gallon drum containing approximately 40 to 60 percent TCE was discarded each day. Soil and groundwater contamination has been identified at the MAG-1 Area during previous investigations (Dames and Moore, 1993).

Ft. Dix is drained by the perennial and intermittent tributaries of Crosswicks Creek and the North Branch of Rancocas Creek. The climate at Ft. Dix is described as humid continental, and is characterized by moderate precipitation, temperature, and wind velocities. The average temperature in the area is 54° fahrenheit (F), with average lows of 31°F in January and average highs of 76°F in July. The average annual precipitation is 44.0 inches.

## 2.4 Field Operations

Field activities to be performed in conjunction with the RI/FS include: mobilization, GPR surveys, and downhole geophysical borehole logging; excavation of test pits, installation of monitoring wells, soil borings, and screened auger borings; slug testing and aquifer testing; collection of surface and subsurface soil samples,

surface water samples, sediment samples, and groundwater samples, and wetland delineation. Details concerning the proposed field activities are presented in the Technical Plan and are summarized below.

### 2.4.1 Mobilization

To streamline field tasks and minimize project delays at commencement of field activities, the following mobilization tasks will be implemented prior to initiating field investigation activities:

1. A central office facility (e.g., trailer or permanent structure) will be established to function as headquarters for ABB-ES field program activities. The field office will, at a minimum, have electrical power and telephone communication. Additionally, based on the size of the field program, the field office may contain a two-way radio base station, portable computer, and copy machine. The office will also serve as the location for field project files and field equipment storage.

2. Subcontractor drilling and excavation equipment and supplies are to be staged in a designated location during mobilization, prior to the initiation of subsurface exploration activities. The equipment will be decontaminated prior to arrival on-site as prescribed in Subsection 2.6.3.

3. A temporary, centrally-located decontamination pad will be constructed during drilling and excavation equipment mobilization and prior to the initiation of field activities (see Subsection 2.6.3).

4. All sampling and health and safety equipment and materials will be staged in the field office.

5. Team meetings will comprise the final phase of mobilization. Meetings will focus on project health and safety requirements, installation policies and procedures to be followed, field sampling procedures, site access requirements, and drilling requirements (e.g., decontamination, waste handling, and well installation).

6. Mobilization may also include establishing the field laboratory and establishing a sampling schedule with the analytical laboratory.

### 2.4.2 Geophysical Techniques

Geophysical surveys can be used to identify buried objects or features such as utility lines/pipes, former disposal trenches or pits, buried drums and/or waste material. The surface geophysical technique to be used as part of this field investigation will be GPR. Borehole geophysical logging can assist in interpretation of subsurface stratigraphy. This is particularly true in areas such as the New Jersey coastal plain where many wells have already been logged. Natural gamma logging will be conducted on selected borings and monitoring wells to assist in placing the site-specific geologic setting within the regional stratigraphic framework.

**2.4.2.1 Ground Penetrating Radar.** The GPR survey will be conducted in the following manner. Prior to profiling subsurface conditions with a GPR, a grid system will be established over the survey area to assure accurate location of the profiles. Grid transects will be spaced at approximately 10 to 20-foot intervals in areas where former rubble pile is suspected to be present. The transects will be established using pin-flags, a compass, and a 100-foot tape. The grid will be referenced to trees, fences, and other structures in the survey area for future correlation of the survey results with actual field conditions. GPR traverses along the grid transects will then be conducted to profile subsurface conditions.

GPR uses electromagnetic waves in the frequency range of 80 to 1,000 megahertz to define subsurface stratigraphy. With the GPR technique, electromagnetic energy is radiated downward into the subsurface from an antenna that is pulled slowly across the ground by hand at speeds varying from about 0.25 to 5 miles per hour (mph), depending on the amount of detail desired and the nature of the target. The radio wave energy is reflected from surfaces where there is a contrast in the electrical properties of subsurface materials. These surfaces may be naturally occurring geologic horizons (e.g., soil layers, changes in moisture content, voids, and fractures in bedrock) or manmade (e.g., buried utilities, tanks, drums, or dunnage).

The reflected energy is processed and displayed as a continuous strip chart recording of distance versus time, where time can be thought of as approximately proportional to depth. The depth of penetration of a GPR system is highly site-specific, and generally depends on the soil types at the site (clean sands are best), moisture conditions (dry is best) and the frequency of the antenna (the lower the frequency, the deeper the penetration and the less the resolution).

The GPR unit will generally be operated from a utility vehicle with the remote transmitter/receiver antenna towed either manually or behind the vehicle. Reflected radar signals, transferred to a graphic strip chart recorder on the GPR unit will be interpreted directly in the field by a qualified geophysicist. Interpreted reflectors will be marked at the surface with flagging or spray paint during the survey.

Several factors may adversely effect the quality, and the ability to collect interpretable data. They include: physical access limitations for both the utility vehicle and towed antenna, contrasts in electrical properties between soil and subsurface targets (clay pipe and concrete tanks objects are more difficult to locate than metallic objects because of the lower contrast), the size and depth of subsurface objects (deeper and smaller objects are more difficult to locate), and the clay content and degree of water saturation of soils. Wet clay-rich soils can significantly attenuate the radar signal making interpretation difficult and sometimes impossible.

Proposed survey lines will be concentrated in areas where the targets are likely to occur. Because of the inherent flexibility in data collection, GPR survey lines can be easily relocated in the field based on preliminary interpretations. Survey line spacings will be increased or decreased in response to success of data collection efforts at the time of the survey. The survey will be generally conducted by a two-person crew.

After completing the GPR transects the profiles will be analyzed by a trained geophysicist to evaluate the presence of anomalies which may represent the former rubble pit. The former rubble pile will be mapped and located in the field.

**2.4.2.2 Natural Gamma Logging**. Natural gamma borehole logging is proposed for the MAG-1 Area. The primary use of natural gamma logging is to assist in lithologic identification and stratigraphic correlation. This borehole geophysical technique will be used to help better place subsurface geology at the site within the regional stratigraphic framework.

Gamma ray logging yields a record of the natural gamma radiation detected throughout a borehole. The total contribution of detected gamma rays emitted from potassium-40, daughter products of uranium, and daughter products of thorium are measured. These elements are generally common to clay and clayey deposits which typify some of the coastal plain sediments found at the MAG-1 Area. These elements are concentrated in fine grained sediments through adsorption and ion exchange. The gamma radiation signature is expected to vary from formation to

formation as clay content varies. Gamma radiation is quantified in counts per second (cps).

A sodium iodide crystal is used to detect gamma rays. The crystal is located within a probe which is lowered downhole. When a high energy photon (i.e., gamma ray) strikes the sodium iodide crystal a light pulse is generated. This light pulse is then converted to an electric current and is registered as a count (Keys, 1989).

The gamma ray probe will be lowered into the borehole using a tripod, cable, spool, and other rigging equipment (Mount Sopris System III). Data will be collected beginning at the bottom of the borehole at a rate of 15 to 20 feet per minute (depending on desired resolution). Data will be saved to a field computer equipped with processing and presentation software. Test runs will be conducted to ensure data quality and data reproducibility.

### 2.4.3 Test Pits

Test pits will be excavated to collect subsurface soil samples and characterize shallow subsurface soil conditions. The following discussion outlines test pit excavation procedures. Test pit excavation will be directed by the ABB-ES geologist.

To expedite the sampling and record keeping efforts and to minimize periods of potential exposure during the excavation of test pits, the sampling crew will have sufficient tools and equipment to sample each pit prior to requiring decontamination. Stainless steel spoons, spatulas, and bowls will be used to mix samples. The backhoe, bucket, and boom will be decontaminated before each new test pit in accordance with procedures outlined in Subsection 2.6.3.

The actual layout of each test pit, temporary staging area, and spoils pile will depend on site conditions and wind direction at the time the test pit is made. During excavation, sampling, and logging of each test pit, the backhoe operator and all site personnel will remain upwind or crosswind of the test pit and spoils pile. Wind direction will be monitored by means of a wind sock or other banner located in a prominent position visible to all personnel.

Test pits will be logged by the ABB-ES geologist as they are excavated. Records of each test pit will be made on prepared forms or in a field book (Figure 2-2). If the log is made in a field book, it will be transcribed to prepared forms. These records include plan and profile sketches of the test pit showing all materials encountered

and their depth and distribution in the test pit, sample locations and approximate size of the test pit. These records will also include safety and sample screening information. This format provides a cross-check with chain-of-custody (COC) records and sample label counts. Test pit logging will include photographs of the excavation and closed pit.

The actual depth of samples obtained from each test pit will be selected at the time the test pit is excavated. Additional samples from residues and any fluids encountered in each test pit may also be collected.

Before the test pit is excavated, the backhoe and backhoe bucket will be decontaminated by steam-cleaning with USAEC-approved water to the satisfaction of the geologist. Test pits will be excavated in the following manner:

1. The geologist and subcontractor (including the backhoe operator) will plan the excavation.

2. After the area to be excavated has been cleared, the backhoe operator will excavate the test pit proceeding in increments as planned by the geologist and subcontractor.

3. After each increment, the operator will wait while the geologist inspects the test pit to decide if conditions are appropriate for sampling.

4. The backhoe operator, who will have the best view of the test pit, will immediately cease digging if:

   - any fluid phase or groundwater seepage is encountered in the test pit;

   - any drums, or other potential waste containers are encountered;

   - distinct changes of material are encountered; or

   - the geologist directs the operator to cease digging.

   This action is necessary to permit proper sampling of the test pit and to prevent a breach of safety protocol. For instance, should any fluids or seepage be encountered, they could, after suitable screening and monitoring, be sampled. Waste and sludge deposits could likewise be sampled before

proceeding. Should uncollapsed drums be encountered, the test pit will be terminated, backfilled and redug at an adjacent location.

Test pits will be secured, when open, during the day and backfilled with materials excavated from the test pit at the end of each day. Efforts will be made to backfill the test pits in a fashion which minimize mixing and spreading of contaminated material. Upon closure the four corners of the test pit will be staked.

### 2.4.4 Exploratory Drilling

Drilling of shallow borings will be attempted using 4.25-inch inside diameter (ID) hollow stem augers (HSAs) and 4-inch outside diameter (OD) mud-rotary drilling. Borings to be completed as overburden groundwater monitoring wells will be advanced using 6.25-inch ID HSAs and 8-inch and 10-inch outside diameter mud-rotary drilling for shallow, intermediate and deep monitoring wells. The resulting diameter of the borehole for monitoring wells will be 8.25 to 9.5-inches.

**2.4.4.1 Predrilling Activities and Permitting.** A qualified drilling subcontractor(s) will supply the necessary type and number of drilling rigs capable of performing the drilling technique appropriate for the existing subsurface conditions. This subcontractor(s) will drill boreholes and install monitoring wells under subcontract to ABB-ES. Prior to implementing the proposed drilling plan, the drilling subcontractor will complete the following tasks:

- All required boring/well drilling permits will be secured.
- Drill sites will be arranged (e.g., the drilling subcontractor will have containment materials on hand) to minimize the potential for the possibility of spills and leaks from the drilling operation entering the borehole;
- Drilling tools and rigs will be steam-cleaned prior to being delivered on-site. Drill rig and tools will be steam-cleaned on-site with USAEC-approved water, prior to beginning the soil boring program. Between borings and well installations, down-hole drilling tools will be decontaminated by steam-cleaning using USAEC-approved water at the decontamination area. The drill rig will also be steam-cleaned if it becomes contaminated from drill cuttings or grout.

- Well drilling equipment and well installation supplies will be stored in the staging area. At each drill location, clean equipment/supplies will be temporarily stored on sheets of disposable polyethylene sheeting to eliminate contamination from the native soils at the well location. Well screen and riser will be steam cleaned and rinsed with analyte free water prior to installation as described in the USAEC Geotechnical Requirements. Well materials will be cleaned at the decontamination area, and wrapped in plastic sheeting prior to transport to the drill site. All surfaces coming into contact with decontaminated well materials will be covered with plastic sheeting.

The following USAEC approvals will be obtained by ABB-ES as needed prior to initiating the soil boring program at Ft. Dix.

- Source approval for the potable water to be used for drilling and decontamination will be obtained from USAEC. A nonchlorinated source water supply, identified by Ft. Dix personnel, has been sampled for the analytes listed on Table 3-6 of the Technical Plan. Analytical results from this sample have been approved by the USAEC.

- Bentonite materials will be selected and submitted to USAEC for approval by the Contracting Officer's Representative (COR) or the USAEC geologist a minimum of six working days, prior to mobilization of the drill rigs to Ft. Dix. The following information may be supplied to the COR:

    1. the brand name of the bentonite
    2. the manufacturer of the bentonite
    3. the manufacturer's address and telephone number
    4. description of the bentonite from package labels of manufacturer's brochure (including lot number, batch number, date of manufacture, etc.
    5. the intended use of the bentonite

- Granular backfill (filter pack) materials will also be selected and submitted to the USAEC for approval by the COR or the USAEC Geologist a minimum of six working days prior to mobilization of drill rigs to Ft. Dix. The following information will be supplied to the COR:

1. a one-pint jar sample of the filter pack material
2. lithology of the formation(s) to be screened
3. grain size distribution of the filter pack
4. brand name of the filter pack
5. processing method used to generate the filter pack material (e.g. pit run, screened, washed, crushed, etc.)
6. slot size of intended well screen

### 2.4.5 Drilling Techniques

The boring methods employed at a given site are selected on the basis of subsurface conditions. ABB-ES has prepared detailed drilling specifications that govern the drilling subcontractor's effort. These specifications are modified on a site-specific basis to reflect the needs of each project.

**2.4.5.1 Hollow-Stem Auger Borings.** Soil borings not requiring well installations may be advanced with 4.25-inch HSAs. Soil borings requiring well installations may be advanced with 6.25-inch HSAs. With this technique, HSAs are advanced into the soil. Drill cuttings are compressed laterally and carried upwards on the auger flights. The bottom of the auger may be blocked with a plug while the auger is advanced. When the desired sampling depth is reached, the plug is withdrawn and a sample is obtained from below the bottom of the auger. The advantages of the HSA technique include:

- simplicity of procedure;
- low risk of personnel exposure;
- can be used to obtain soil samples from a wide range of subsurface conditions;
- drilling fluids are generally not required; and
- availability of equipment.

The disadvantages of the HSA technique include:

- difficulty in penetrating excessively cobbled or bouldered soils; and

- difficulty in sampling granular soils below the water table since, without drill fluids, there is no practical means to maintain hydrostatic equilibrium in the borehole. When the plug is withdrawn, water and sediment from outside the augers may enter the borehole, potentially causing contamination and difficulty in sampling undisturbed soil below the bottom of the augers. If necessary, approved source water may be added to the borehole annulus to control this heaving soil condition.

**2.4.5.2 Mud Rotary**. The mud rotary drilling method will be used to drill the boring for the installation of the deep monitoring well and may be used to drill the intermediate monitoring well borings and geologic borings at the MAG-1 Area. Drilling fluid used in this process will consist of approved and tested water and pure bentonite. The bentonite/water drilling fluid will promote borehole stability in the unconsolidated formations, control the problem of heaving sands typically encountered in these formations, and will allow for downhole sampling.

The following procedures will be completed in preparation for mud rotary drilling:

a. Surface casing will be positioned and installed approximately 4 feet into the ground.

b. A bentonite surface seal will be placed around the surface casing.

c. A steel mud pit will be set in place and leveled. The capacity of the mud pit will be calculated by the Geologist and any fluid losses/ additions will be recorded during the drilling process.

d. The mud pit will be filled with approved water and powdered bentonite will be added.

Following these initial set procedures, the boreholes will be advanced using the following techniques:

- A 4- or 10-inch roller cone or drag bit will be used to advance the soil boring or monitoring well boring to termination depth

- If a monitoring well installation is planned, then the mud will be thinned with USAEC-approved source water prior to monitoring well construction.

- If a confining layer is to be fully penetrated, a permanent 9-inch steel casing will be installed and grouted into place prior to borehole advancement with an 8 inch roller cone or drag bit. It is anticipated that only the soil boring for the deep monitoring well, to be screened in the Mt. Laurel Formation, will require this double cased drilling.

Soil samples for lithologic description will be collected using a split spoon sampler at depths where no adjacent boring (e.g. an intermediate well) has been sampled. Where soil sampling is necessary it will generally be conducted at five-foot intervals. All lithologic samples will be described according to the procedures outlined in Subsection 2.5.1.4.

All mud which circulates to the surface during drilling operations will be containerized in the steel mud pit. Cuttings which settle out during drilling and all drilling fluid removed from the boring will be containerized in 55-gallon DOT-approved drums, labeled, dated and stored on-site at Ft. Dix. Disposition of containerized cuttings and drilling fluid will be carried out by Ft. Dix in accordance with the New Jersey Department of Environmental Protection and Energy (NJDEPE) and USAEC requirements.

### 2.4.6 Monitoring Well Installation

**2.4.6.1 Monitoring Well Design and Construction.** Upon completion of monitoring well borings the monitoring well will be constructed in the borehole annulus. After the well is placed in the boring filter pack and sealing materials will be placed around the well as the drill casing is withdrawn.

The following materials will be used in well construction:

a. Monitoring wells - flush-threaded polyvinyl chloride (PVC) Schedule 40 casing with 4-inch inside diameter. No PVC solvents or glues will be used. The well screen will be factory slotted, with a slot width of 0.010 inch screens will be 10 feet long. A water tight lockable cap will be placed on top of the riser in any flush mounted well.

b. Grout, composed (by weight) of 20 parts portland cement (type II or V) up to one part bentonite with a maximum of 8 gallons of approved source water per 94-pound bag of cement. Bentonite will be added after mixing of the cement and water.

c. Commercially available bentonite pellets designed for well-sealing purposes, or in the case of the intermediate and deep wells a thick bentonite slurry. Bentonite utilized for well seals will be approved by the COR prior to use at the MAG-1 Area in accordance with Subsection 2.4.4.1.

d. Sand material, used in the filter pack around the well screen, compatible with both the screen slot size and aquifer materials. Filter pack materials will be approved by the COR prior to their use on site in accordance with Subsection 2.4.4.1.

e. An eight-inch protective iron casing installed over the top of the PVC riser. This casing will extend approximately 2.5 feet above ground surface and will be seated 2.5 feet into the well seal grout. It will be vented to the atmosphere via a padlocked cap, which will prevent entry of water but will not be airtight. A ¼-inch diameter drainage port will be installed, above the level of the internal mortar collar. Wells finished below grade will have a 1 foot diameter manhole or valve box designed cover with a lockable water tight cap for the PVC casing. Well designations including the state of New Jersey well permit numbers and Ft. Dix site identification will be painted on the protective casing.

Locks used to secure the monitoring wells will be keyed alike. Figure 2-3 illustrates a typical monitoring well installation diagram.

If shallow monitoring wells are screened at a shallow water table, modifications to the USAEC geotechnical requirements may be necessary. Due to the anticipated shallow water table (5-10 feet below surface), and the required length of the filter pack overlap (at least 5 feet above the screen), the required length of the bentonite seal or filter pack may be shortened so that the screened interval spans the water table. This modification will be made only after obtaining approval by the USAEC Geologist and COR.

**2.4.6.2 Monitoring Well Construction Procedures.** When a monitoring well boring is completed, the Geologist will visually inspect the hole. Plumbness will be obtained by careful leveling of the drill rig prior to the commencement of drilling. Well installations will begin within 48 hours of boring completion, and, to the extent practicable, will continue uninterrupted until completed.

The well screen and riser will be carefully steam cleaned and rinsed with analyte-free water prior to being installed in the hole. Well screens will have a solid bottom. Solid casing will extend from the screen to approximately 2.5 feet above ground surface.

After the monitoring well screen and casing has been placed in the borehole, filter pack material, previously approved by the COR (see Subsection 2.4.4.1) will be gradually placed around the well screen as the drill casing is slowly withdrawn. The top of the filter pack will be periodically sounded to assess the location of the filter pack within the borehole annulus. Upon completion, the filter pack material will extend to approximately five-feet above the top of the well screen.

In monitoring wells with less than 10-feet of water above the top of the filter pack, a five-foot thick bentonite pellet seal will be installed to isolate the well screen (see Subsection 2.4.4.1 for bentonite approval). Bentonite pellet seals will be allowed to hydrate for a minimum of one-hour before cement-bentonite grout is added to the borehole annulus.

In monitoring wells having more than 10-feet of water above the filter pack a thick bentonite slurry seal will be tremie pumped above the filter pack. In both instances (pellet or slurry seal) the drill casing will be slowly withdrawn as the seals are placed.

Slurry and grout materials shall be combined in an above-ground rigid container or mixer and mechanically, not manually, blended on-site to produce a thick, lump-free mixture throughout the mixing vessel. The mixed slurry/grout shall be recirculated through a pump prior to placement. Slurry/grout shall be placed using a pump and tremie pipe. The pump for recirculation and placement shall be a commercially available product specifically manufactured to pump cement grouts. The tremie pipe shall be of rigid, not flexible, construction. Drill rods, rigid PVC or metal pipes are acceptable tremies. Hoses and flexible PVC are unacceptable.

A cement-bentonite grout will be placed in the annular space above the bentonite seal layer. The cement-bentonite grout seal will extend from the top of the bentonite seal to ground surface. Grouting will be completed as a continuous operation in the presence of the ABB-ES geologist. The grout will be pumped into the annular space under pressure using a tremie pipe placed at the top of the bentonite seal to ensure a continuous grout seal. The protective casing will be sealed in the grout.

Modifications to monitoring well installation requirements may be necessary if the depth to groundwater is shallow. The bentonite seal and sand-pack extension may be reduced, though it is preferred that the bentonite seal not be less than 4 feet. Modifications to installation requirements will only be implemented with prior approval from USAEC.

An eight-inch diameter aboveground steel protective casing or a one-foot diameter flush-mounted valve box will be sealed in the cement concrete surface cover to secure the well against tampering. After the grout seal has set (approximately 24 hours), it will be checked for settlement, and additional grout (of approved composition) will be added to fill any depressions. Protective posts will be installed around the aboveground finished well to prevent damage to the wells by vehicular operation.

Identification/protective posts and wire will be installed around the well to prevent damage to the wells by vehicular operation or grazing. A concrete pad, 6 inches thick, sloping away from the well extending 2 feet radially from the protective casing, will be placed around each well. Figure 2-4 illustrates a typical monitoring well construction diagram.

A monitoring well construction diagram will be prepared for each monitoring well. This diagram will indicate the bottom of the boring, screen location, filter pack location, bentonite seals, cement-bentonite grout, height of riser above ground surface, and protective casing detail. The actual composition of the grout, seals, and granular backfill will also be recorded.

### 2.4.7 Piezometer Installation

Piezometers will be installed to instrument the aquifer tests to be conducted as part of the RI at the MAG-1 Area. The situation may be encountered where two piezometers are installed in one borehole at different elevations, with prior approval from USAEC. Except for the PVC, the materials will be identical to those described in Subsection 2.4.6.1. The PVC used for the piezometer installation will consist of threaded PVC Schedule 40, 2-inch or 1.5-inch (nominal) ID well riser. No PVC solvent will be used. The piezometer screen will be 5 or 10 feet in length, factory-slotted with a slot width of 0.010 inch. A loose-fitting PVC cap will be used to cover the top of the piezometer riser and will allow equilibrium of the well water level with atmospheric pressure. Installation procedures will be identical to those described in

Subsection 2.4.6. However, if two piezometers are installed in one borehole they shall be separated by a bentonite seal.

### 2.4.8 Monitoring Well Development

Information recorded during initial development or purging of the drilling fluid from monitoring wells will be recorded and submitted to the COR within three working days after development. The development will be performed, as soon as practical, after well installation; not sooner than 48 hours and not later than 7 days following placement of the mortar collar. A well Development Record (Figure 2-5) will be used to document the following well development data:

- well designation;
- date of well installation;
- date of development;
- static water level before and after development;
- quantity of drilling fluid lost during drilling;
- quantity of standing water in well and annulus (30-percent porosity assumed for calculation) prior to development;
- dissolved oxygen conductivity, temperature, turbidity and pH measurements taken and recorded at the start, twice during, and at the conclusion of development;
- depth from top of well casing to bottom of well;
- screen length;
- depth from top of well casing to top of sediment inside well, before and after development;
- physical character of removed water, including changes during development in clarity (measured with NTU meter), color, particulates, and odor;

- type and size/capacity of pump and/or bailer used;
- height of well casing above ground surface;
- typical pumping rate;
- estimate of recharge rate; and
- quantity of water removed and time for removal.

Development of wells will be accomplished with an electric-powered submersible pump and/or bailer. Bailers will be used to develop wells only where the volume of water is so small that other development methods are clearly inappropriate. The pump will be periodically raised and allowed to drain back into the hole in order to induce flow out through the well screen. A surge block may be used, with USAEC approval, in instances where field personnel expect that development may be improved by its use. Water will not be added to the well to aid in development. The pump will be decontaminated with USAEC-approved water prior to use in the next well (see Subsection 2.6.2). Development fluids will be containerized and handled as described in Subsection 2.6.4.

USAEC defines a well to be fully developed when all the following criteria are met:

- the well water is clear to the unaided eye;
- the sediment thickness remaining in the well is less than 1 percent of the screen length; and
- the total volume of water removed from the well equals five times the standing water volume in the well (including the well screen and casing plus saturated annulus, assuming 30 percent porosity) plus five times the volume of drilling fluid lost.
- The cap and all internal components of the well casing above the water table will be rinsed with well water to remove all traces of soil, sediment, and cuttings. This washing will be conducted before and/or during development.

- At the conclusion of the well development, a photograph of the well water, in a clear glass jar, shall be taken.

Where possible, well development will continue until turbidity measurements vary by less than approximately 10%. Should the recharge to the well be so slow that the required volume cannot be removed in 48 consecutive hours, the water remains discolored, or excess sediment remains after the five-volume removal, the COR will be contacted for guidance.

A 1-pint sample of the last water obtained from the development process for each well will be retained as required by USAEC.

### 2.4.9 Septic Tank and Underground Storage Tank Sampling

The septic tank and underground storage tank structures located at the MAG-1 Area will be sampled for VOCs, as well as TPH (UST only), and lead (UST only). The top of these structures are evident at the ground surface at the MAG-1 Area. Samples will be gathered by removing the manhole covering the top of each structure while carefully monitoring the ambient air quality with a PID. Surface conditions adjacent to the structures will be recorded.

Samples will be collected with a pac-bomb sampler, bailer, or stainless steel bucket attached to a pole. After the sample bottles are filled and processed, the fluid depth within the structures will be measured. If possible, an estimate of the interior dimensions of the structures will be made including an assessment of piping leading to the structures.

## 2.5 SAMPLING TECHNIQUES

The procedures described in the following subsections of Section 2.5 will govern the collection of samples for the MAG-1 Area. Samples to be collected as part of the MAG-1 RI field program include: subsurface soil, sediment, surface water, and groundwater.

### 2.5.1 General Soil Sampling Methodology

The soil/sediment sampling program at the MAG-1 Area has been developed to define the location, nature, and concentration of contaminants in surface and subsurface soils and sediments at the site.

Development of a soil/sediment sampling plan to evaluate the distribution and magnitude of contamination at a specific site requires at a minimum:

- an assessment of the site conditions;
- evaluation of the methodology and results of any previous sampling and analysis programs which may have been completed at the site; and
- definition of the scope and objectives of the project.

A number of techniques have been developed to obtain samples from various depths below the ground surface. The techniques described herein are those normally employed by ABB-ES. They have been selected to provide a practical and efficient means of obtaining samples in a manner consistent with safety protocols and QA/QC requirements. Additionally, they employ equipment that is normally available for use.

The selection of sampling techniques to be employed at a given site is based upon the depth from which samples must be obtained, the types of exploration, and/or the nature of the soils to be sampled. The sampling techniques are categorized by the depths or the types of explorations from which they are obtained:

- shallow soil samples, from depths of less than 6 inches;
- test pit samples from depths up to approximately 15 feet;
- subsurface soil samples from test borings at variable depths; and
- sediment samples from depths of less than 6 inches.

**2.5.1.1 Soil Sample Logging and Shake Test Procedures.** All soil samples collected will be logged in the field at the time of sampling by the field geologist. Soils shall be classified in accordance with the Unified Soil Classification System (USCS) (Table 2-1). Soil samples will be described fully on the appropriate sampling logs. The descriptions for intact samples (e.g., undisturbed split-spoons, test pit walls) will include the following parameters.

- General Description
- USCS Symbol
- Secondary Components and Estimated Percentages
- Color
- Plasticity
- Consistency/Density
- Relative Moisture Content
- Texture/Fabric/Bedding
- Grain Angularity
- Depositional Environment/Formation (unit) Name, if appropriate

If disturbed samples must be described (e.g., auger flight samples, wash samples, backhoe bucket samples), the parameters outlined above shall be used to the extent practical. In general, a substantially reduced level of detail will be appropriate for disturbed samples.

Soil-Water Shake Test Procedures. Soil samples collected from the source area soil borings and MAG-106C which have PID readings above background and exhibit a soil texture characteristic of non-aqueous phase liquid (NAPL) will be submitted for a field soil water shake test. This test, for which there are no explicit written procedures, will be conducted by placing approximately equal amounts of soil sample and source water in a clear glass jar to create a separate soil water mixture. A small amount of the hydrophobic dye Sudan IV will then be added to the mixture. The cover will then be secured over the glass jar and the mixture will be manually shaken for approximately 10 seconds. After this the fluid in the jar will be visually examined to assess if a separate NAPL layer has formed.

**2.5.1.2 Surface Soil Sampling.** Soil samples will be collected to determine the nature and extent of near-surface contamination. Surface soil samples will be gathered using a shovel, trowel, hand auger or tulip bulb planter. The material collected will be placed in a stainless steel bowl. Further mixing will be accomplished with a stainless steel spoon or spatula. After collection of the VOC sample, the remaining sample will be homogenized utilizing the coning and quartering technique.[2] The soil samples will be placed in pre-labeled sample jars,

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[2]Coning and Quartering Method: Non-VOA samples should be homogenized using the following procedure: First remove rocks, twigs, leaves, and other debris, if they are not considered part of the sample. Then the soil/sediment should be removed from the sampling equipment and placed in a

capped, covered with a custody seal, and sent for laboratory analysis. Remaining sample will be discarded into the 55-gallon Department of Transportation (DOT)-approved drums being used for collection of cuttings. Appropriate sample containers are described in Subsection 5.2. Information regarding sample location, depth, and character will be recorded on a Surface Soil Sample Record (Figure 2-6). Further data and some of the preliminary COC information will be recorded on the Surface Soil Sample Field Data Record (Figure 2-7).

In the event it is necessary to remove asphalt to collect the sample, a pickaxe or jackhammer may be used. All sampling and asphalt-removal equipment will be decontaminated between sample collections as described in Subsection 2.6.3.

**2.5.1.3 Test Pit Sampling.** To sample the test pit from the ground surface, two methods may be used. In either case a shovel or trowel may be used to gather sample material. Only stainless steel spatulas, bowls and spoons will be used to mix and manage the sample. The method will be selected in the field at the time the test pit is sampled.

- Samples can be obtained from the backhoe bucket. The geologist will direct the backhoe operator to remove material from the selected depth or location within the test pit. The bucket will be brought to the surface and moved away from the pit. The geologist will approach the bucket and monitor its contents with the photoionization detector (PID) and record the reading in the log. If granular or loose soils and/or uniform materials are encountered, the sample will be obtained directly from the bucket. The sample is collected from the center of the bucket and placed in sample jars as described in Subsection 2.5.1.2. Appropriate sample containers will be used as described in Subsection 5.2.

  If cohesive soils or multiphase conditions are encountered (e.g., the bucket contains a mixture of soil and sludge) so that obtaining a sample from the bucket is not practical, the sampler may direct the

decontaminated stainless steel pan. The sample is then thoroughly mixed using a decontaminated stainless steel spoon. The soil/sediment in the pan should be scraped from the sides, corners, and bottom of the pan, rolled to the middle of the pan, and initially mixed. The sample should then be quartered and moved to the four corners of the pan. Each quarter of the pan should be mixed individually, and then rolled to the center of the container and the entire sample mixed again.

backhoe operator to empty the bucket onto the ground. The geologist will obtain the sample from the interior of soil clods or lumps of sludge using a clean trowel or spatula.

- Samples can be obtained directly from the test pit. This is necessary when soil conditions preclude obtaining suitable samples from the backhoe bucket (e.g., caving or excessive mixing of soils or wastes within the test pit) or when samples from relatively small discrete zones within the test pit are required. In these circumstances, samples will be obtained by means of extendable handled tools: scrapers, trowels, spoons or cups. The face of the test pit will be scraped to remove the smeared zone that has contacted the backhoe bucket. The material to be sampled, if a solid, is then removed from the test pit wall by means of long handled scoops or trowels.

**2.5.1.4 Subsurface Soil Sampling.** Sampling procedures for obtaining subsurface soil samples for the different drilling techniques are presented in the following subsections.

Soil Test Borings. The work site geologist will collect soil samples for physical and analytical testing and geologic classification at predetermined boring locations. The soil samples will be collected from pre-determined sampling intervals or, whenever subsurface conditions warrant. The latter condition will be determined by the geologist.

The samples for laboratory analysis will be collected using a 3-inch OD split-spoon sampler driven with a 140 or 300 pound hammer. Samples collected for geologic classification will be collected in accordance with American Standards and Test Methods (ASTM) D-1586 Standard Penetration Testing using a 3-inch OD split-spoon sampler driven with a 140 or 300 pound hammer. The collection of the samples will be in accordance with the following procedures:

- The appropriate number and type of laboratory-cleaned samples bottles will be available for use at the boring location. Refer to Subsection 5.2 for a summary of bottle requirements.

- Sample labels will be placed on the sample bottles prior to, or at the time of sample collection. The sample labels will be either preprinted or will be filled out using waterproof, permanent ink and will include

sample identification, location, date and time, as well as the initials of the sampler and the analysis to be performed. Sample numbers for identification are discussed in Section 5.0 of this QAPP. Clear plastic tape will be placed around the sample label to insure its integrity and a custody seal will be secured over the sample cap.

- The split-spoon will be advanced ahead of the drill casing at the appropriate depth using the 300 or 140 pound hammer. Blow counts will be recorded by the inspecting geologist for every 6-inches the split-spoon is advanced.

- The driller will remove the split-spoon from the borehole and unscrew the ends, slowly and carefully opening the split-spoon as the inspecting geologist monitors the sample with a PID. The geologist will quickly collect and place the volatile organic compound (VOC) sample in the appropriate jars using a clean stainless-steel spatula. After collection of the VOC sample, the remaining sample will be placed in a decontaminated stainless steel bowl and homogenized using the coning and quartering method (see Subsection 2.5.1.2). The remaining analytical jars will be filled using a stainless steel spatula. Remaining sample will be discarded into the 55-gallon DOT-approved drums being used for collection of cuttings. During this process, the geologist will note lithologic changes observed in the sample as required by the USAEC Geotechnical Requirements. The boring lithology will be recorded on a Soil Boring Log (Figure 2-8). Copies of the original soil boring logs will be transmitted to USAEC within three working days of boring completion. The originals will be transmitted to USAEC upon completion of the written report.

- The split-spoons and stainless-steel sampling trowels will be decontaminated between samples using procedures outlined in Subsection 2.6.3. All sampling equipment used for collecting laboratory analytical samples will be decontaminated in accordance with the procedures set forth in Subsection 2.6.1.

Shelby Tube Sampling. Collecting and transporting soil samples in a nearly "undisturbed" state is required for certain treatability, hydraulic, and geotechnical tests. It is recognized that this cannot be done without some degree of sample disturbance, but care will be taken to minimize disturbance.

Shelby Tube sampling is a common method of "undisturbed sampling." As applied herein, Shelby Tube sampler refers to any open-drive sampler consisting of thin-walled seamless steel tubing with a sharp and drawn-in cutting edge, which can be connected to a sampler head or adaptor containing a check valve and vents for escape of air and water. (Thin-walled refers to a wall thickness typically less than 2.5 percent of the diameter of the sampler.) Shelby Tubes are disposable samplers that are used for sample collection, transport, and typically for testing as well.

Whenever possible, the Shelby Tube will be forced into the soil by fast, uninterrupted pushing. A heavy drop hammer will be used where pushing provides insufficient penetration. In both cases care will be taken to minimize interruptions during sampler penetration and to eliminate rotation of the sampler. Total penetration should not exceed the net length of the sampler (i.e., the sampler should not be underdriven or overdriven).

In order to allow full development of adhesion and friction between the sample and the sample tube, it is helpful to wait 10 to 20 minutes before beginning sample withdrawal. The drill rods should be rotated through two or three full revolutions to separate the sample from the subsoil, immediately after which the sampler should be withdrawn slowly and smoothly.

The Shelby Tube will be marked with the sample ID and date and with an indication of which end of the tube is the stratigraphic top. If laboratory analytical samples are to be collected with Shelby Tubes, the ends of the tube will be secured with teflon tape to the extent practicable. Aluminum foil will be placed against the soil at both ends of the tube; bubble-wrap or other suitable cushioning material will be inserted between the foil and the end of the tube (if the sample does not entirely fill the tube); and plastic caps will be secured by tape over both ends of the tube. Wax seals may be used only if provisions are made to prevent contact between the wax and the soil. The samples will be kept upright at all times.

Shelby Tube samples will be stored and transported in a framework that supports them in an upright position and cushions them from vibrations.

**2.5.1.5 Geotechnical Sampling**. Samples will be obtained from selected borings for geotechnical laboratory testing. The purpose of geotechnical testing will be to verify field soil classifications and to support the characterization of geologic units encountered during the field investigation. Specific tests will include, Atterberg

Limits, Particle Size Analysis, and Visual-Manual Description of Soils. This section describes sample collection and standard geotechnical testing to be performed.

The test methods to be used do not require "undisturbed" samples; therefore, special drilling procedures to limit sample disturbance will not be necessary. The primary method for obtaining geotechnical test samples will be with split-spoons driven in accordance with the Standard Penetration Test procedure (see Subsection 2.5.1.3). Shallow test pit sampling and/or other sampling techniques may also be employed. Immediately after opening the split spoon, a PID reading will be obtained on the sample and recorded on the boring log. Following field identification and logging of the sample, a representative portion will be selected and placed in a clean, standard 12-ounce reference jar. A minimum sample size of 8-ounces will be obtained for all three types of geotechnical tests to be performed. A label shall be fixed to the side of each jar which shows plainly, the ABB-ES Project Number, the boring and sample numbers, the depth of the sample below ground surface and the number of blows for each 6-inches of penetration or fraction thereof. PID readings shall be obtained within the sample jar (head space), one to two hours after placement in the jar and recorded on the jar label and the boring log.

Soil jars shall be tightly closed to minimize moisture loss and protected from freezing. No other sample preservation requirements will be necessary. The samples will be shipped to the geotechnical laboratory with appropriate packing to prevent damage during shipment. Field boring logs will be sent to the laboratory along with the instructions for testing for each sample. Upon completion of the testing, the geotechnical laboratory will ship back to ABB-ES the unused or residual portions of the samples. ABB-ES will dispose of the residual material within one drill cutting drum used during the field investigation.

All geotechnical testing will be performed in accordance with ASTM standard procedures. Atterberg Limit Tests (ASTM D4318) will generally be performed on soils exhibiting some degree of plasticity (i.e., clays and silts). Particle Size Analyses (ASTM D422) will generally be performed on granular soils or soils with appreciable amounts of sand and gravel material. Visual Soil Classification will be performed on selected samples of cohesive and granular soils. The classifications will be performed in accordance with ASTM D2488, Standard Practice for Description and Identification of Soils - Visual Manual Procedure. The determination of samples to be tested will be made in the field by an ABB-ES geologist.

### 2.5.2 General Water Sampling Methodology

The water sampling program at the MAG-1 Area has been developed to define the location, nature, and concentration of contaminants in site surface water and groundwater. The location and distribution of contaminants at the MAG-1 Area are governed by many factors, including:

- site operation or waste disposal practices;
- site design;
- site closure;
- waste characteristics;
- site topography and surface drainage;
- climate; and
- site hydrogeology.

Development of a water sampling plan that will effectively reveal the distribution and magnitude of contamination at a specific site requires:

- an assessment of the factors listed above;
- evaluation of the methodology and results of any previous sampling and analysis program which have been completed at the site; and
- definition of the scope and objectives of the project.

**2.5.2.1 Surface Water Sampling**. Surface water samples will be collected from surrounding streams, ponds, lakes, and ditches to determine the extent of contaminant migration via surface water and runoff.

Each surface water sample will be collected in the following manner:

1. The sampler will collect the sample from the surface water body by immersing a sample collection device, or sample bottle upside down, below the surface of the water and then turn the bottle or sampling device upright, to avoid collecting floating debris. For surface-water sampling from specific depths in the water column, samples will be collected using a teflon or stainless steel bailer; a submersible pump and tubing; a specialized sampling device such as a van Dorn, Kemmerer, or Nansen bottle; or other suitable device. Reusable samplers will be decontaminated with approved decontamination water before

each successive sample is collected. The sample will be collected from a location in the water body that is, in the judgment of the sampler, well-mixed and therefore representative of the water body.

At surface-water sampling locations where surface water may not be present at the time of sampling, sumps may be dug for collecting samples of shallow groundwater. Sumps will be dug by hand to below the water table, and may be left to stabilize for at least 24 hours before sample collection. During the period before sampling, the sumps will be covered to minimize the introduction of surface soil and debris. Samples will be collected by direct immersion of sample containers. If the sump is too shallow for direct immersion, stainless steel or teflon sampling equipment may be used to collect and transfer the water to the sample containers. Digging tools and sampling equipment will be decontaminated prior to each use as described in Subsection 2.6.1.

2. The appropriate sample containers, as outlined in Subsection 5.2, will be directly filled from the sampling device if needed. Preservatives will not be added to the bottles before sample collection. For VOC samples, free air bubbles adhering to the sides of the sample container will be removed prior to capping.

3. Sample labels will be placed on the sample bottles prior to, or at the time of sample collection. The sample labels will be either preprinted or will be filled out using waterproof, permanent ink and will include sample identification, location, date and time, as well as the initials of the sampler and the analysis to be performed. Sample numbers for identification are discussed in Section 5.0 of this QAPP. Clear plastic tape will be placed around the sample label to insure its integrity and a custody seal will be secured over the sample cap.

4. The sampler will measure the following parameters, if possible, in the water body, not the sample:

   - PID reading, above the water;
   - temperature;
   - pH;
   - specific conductance; and
   - any other site-specific field measurements required.

If direct measurement is not possible, the sampler will measure these parameters from water remaining in the sampling device or another sample bottle. This information will be recorded on the sample data record; sample labels will be completed; and COC procedures will be initiated.

5. The sampler will complete the Surface Water and Sediment Sample Field Data Record (Figure 2-9).

**2.5.2.2 Sediment Sampling.** Sediment samples will be collected in conjunction with surface water samples to help define partitioning of chemicals between the sediment and water. The sample location will be noted on a base plan or aerial photograph and marked in the field with flagging and a 4-foot wooden stake. The stake will be labeled with the site identification number.

When both water and sediment samples are to be collected at a given sampling location, the water samples will be collected prior to the sediment sample. The sediment samples will be collected in the following manner:

1. The sampler will select the sample location, identify it on a site map or aerial photograph, and set the wooden stake, as close as practicable onshore. For offshore sampling locations, temporary buoys may be set. Sediment samples should be collected from depositional areas.

2. A gravity corer or stainless steel spoon will be used to collect river and pond samples. If the water is shallow enough, the gravity corer will be pushed directly into the substrate until approximately 1 inch (25 centimeters) or less of the core is above the sediment/water interface. If the substrate is hard or coarse, the corer will be gently rotated while it is pushed to facilitate greater penetration, and reduce core compaction. The corer or spoon will be gently removed from the sediment to avoid losing the sample, and raised to the surface so the sample may be retrieved. The samples should contain greater than 30 percent solids. The sample will be collected from a depth of 0 to 6 inches, to the extent practicable.

3. For collection of sediment samples beneath deep water and/or where recovery of sediment and substrate is intended, a vibratory coring system may be employed from a boat or floating platform. The system will use a high frequency vibratory drive. Sediment/substrate core will be collected in a core tube with a butyrate, acrylic, or poly liner. The sediment core and liner will

be removed from the core tube and will be logged by a geologist on a Sediment Core Log (Figure 2-10).

4. Sediment samples will be handled in a manner similar to that described in Subsection 2.5.1.2 and logged in accordance with Subsection 2.5.1.1.

5. Sediment sampling information will be recorded on the Surface Water and Sediment Field Data Record and COC procedures will be initiated (Figure 2-9).

A minimum of 500 grams of sediment will be collected at each location. Therefore, with the gravity corer, one tube (with a 4-inch or 12-inch long core, with a 2-inch OD) is adequate for one sample as the volume of each core would be approximately 750 milliliters. For other tube sizes and core lengths, the number of tubes necessary can be calculated by using the formula for the volume of a cylinder ($\pi r^2 h$).

At intended sediment sampling locations where surface water may not be present at the time of sampling, sumps may be dug as described in Subsection 2.5.2.1. Soil samples shall be collected from the saturated zone using a stainless steel spoon or auger. Digging tools and sampling equipment will be decontaminated prior to each as described in Subsection 2.6.1.

**2.5.2.3 Staff Gauges.** Two staff gauges will be installed along the tributary to Indian Branch located adjacent to the MAG-1 Area. The gauges will be located immediately downstream of two of the surface water/sediment sampling stations. This will minimize the potential impacting the surface water/sediment sampling station during placement of the gauge. The gauge itself will consist of approximately one-half to one-inch diameter steel pipe manually driven into the stream bed. The top of the pipe will extend approximately one to two feet above the surface of the water. The top of this steel pipe will be vertically surveyed to the nearest 0.01 foot MSL by a licensed New Jersey land Surveyor.

To maintain repeatability in measuring water levels at the stream gauges an additional bench mark shall be established on a nearby large tree or other stationary object at each stream gauge. This bench mark will enable the stream gauge to be easily reconstructed should it be damaged or displaced. The benchmark will also be vertically surveyed to the nearest 0.01 foot MSL by a licensed New Jersey land surveyor.

**2.5.2.4 Groundwater Sampling.** The sampling of all monitoring wells will be conducted to delineate the distribution of chemicals and to identify and quantify, to the extent possible, the chemicals in the aquifer(s) underlying the MAG-1 Area. The products of monitoring well sampling are as follows:

- groundwater samples from each well;
- on-site measurements of specific conductance, temperature, and pH; and
- depth to static water level at each new, and designated existing, well.

Sampling Preparation Activities. Groundwater sampling equipment will be decontaminated prior to use in accordance with the procedures outlined in Subsections 2.6.1 and 2.6.2. Calibration of the sampling equipment will be in accordance with the manufacturer's suggested procedures and will be completed prior to each day's sampling activities. Daily instrument calibration data will be recorded on the Field Instrumentation Quality Assurance Record (Figure 2-11).

Groundwater samples will be collected from each monitoring well using the procedures described in the following sections. Data generated during groundwater sampling will be recorded on the Groundwater Sample Field Data Record (Figure 2-12). Groundwater Sample Data Records will be submitted to USAEC within three days of completed groundwater sampling.

Sampling of groundwater wells will proceed from the upgradient (background) wells to the downgradient (contaminated) wells as best as can be determined, based on existing data.

Pre-purging Activities. The following activities will be performed immediately prior to purging each well:

1. Check the well for proper identification and location.

2. Measure and record the height of protective casing.

3. After unlocking the well and removing any well caps, measure and record the ambient and well-mouth organic vapor levels using the PID. If the ambient air quality at breathing level reaches 1 parts per million, the sampler will utilize the appropriate safety equipment as described in the Health and Safety Plan (HASP).

4. Measure and record the distance between the top of the well casing and the top of the protective casing.

5. Using the electronic water level meter, measure and record the static water level from the top of the well and check for the presence of an immiscible layer. Measure depth to the well bottom to the nearest 0.01 foot. Upon removing the water level wire, rinse it with USAEC-approved water.

6. Inspect the well head for any signs of forced entry which could invalidate the sampling data.

7. Calculate the volume to be purged using the following formula for a 4-inch diameter well and 10-inch diameter sand pack:

$$\textit{Total Purge Volume} = 5 \times \left( \begin{matrix} \textit{Bottom} \\ \textit{Depth} \end{matrix} - \begin{matrix} \textit{Static} \\ \textit{Water} \\ \textit{Level} \end{matrix} \right) \times 1.68 \ \textit{gal/ft}$$

Purging and Sample Collection. The following steps outline the purging and sample collection activities:

1. In all shallow wells, the sampler will lower the submersible pump intake to just below the top of the water column and begin purging five well volumes. The pump intake will not be lowered below the top of the well screen. If the well screen is dewatered, air may enter the formation, altering the chemistry of the aquifer.

2. In all deep aquifer wells, the sampler will place the pump intake at the static water level and begin purging five well volumes. The pump intake will not be lowered below the top of the well screen. In both water table and deep aquifer wells, low permeability formations may require the pumping rate to be reduced to allow continuous pumping. In this situation, the pumping rate will be reduced to allow the five-volume purge without depressing the water level drastically. If the pumped flow rate drops below 1 gallon per minute, USAEC will be notified to discuss modifications to the standard purging procedures.

3. Purging is considered complete when five well volumes have been purged and when the in-situ parameters (pH, specific conductance, dissolved oxygen, turbidity, and temperature) vary by less than approximately 10 percent between the removal of two successive well volumes. For wells in low permeability locations (i.e., less than one gallon per minute recharge), the well will be purged of one volume and then sampled. Purging of less than five volumes, and sampling before stabilization of in-situ parameters, will only be done with prior approval of the USAEC Project Geologist.

4. The sampler will record the in-situ parameters (pH, specific conductance, dissolved oxygen, turbidity and temperature), once for every volume purged, on the Groundwater Sample Field Data Record.

5. After purging and pump removal, the sampler will lower the decontaminated Teflon or stainless steel bailer to the middle of the screened interval or midpoint of the static water level. Prior to the bailer being lowered, a decontaminated Teflon coated wire, stainless steel leader or polypropylene monofilament line will be attached to the Teflon or stainless steel bailer. The appropriate length of nylon or cotton cord (nylon or cotton cord must not contact the water) will be attached.

6. The sampler will collect the sample(s) in appropriate containers as listed in Subsection 5.2. All sample vials or bottles will be triple-rinsed with sample water prior to collection except for VOC samples. Samples will be placed directly from the bailer into the appropriate rinsed containers. VOC sample containers will be filled first with as little agitation as possible followed by other organic parameters. Metals will not be field filtered. Sample preservation methods are discussed in Section 5.3.

7. Sample labels will be placed on the sample bottles prior to, or at the time of sample collection. The sample labels will be either preprinted or will be filled out using waterproof, permanent ink and will include sample identification, location, date and time, as well as the initials of the sampler and the analysis to be performed. Sample numbers for identification are discussed in Section 5.0 of this QAPP. Clear plastic

tape will be placed around the sample label to insure its integrity and a custody seal will be secured over the sample cap.

8. The sampler will record sampling data on the Groundwater Sample Field Data Record.

9. The well cap and lock will be secured.

Bailers, pumps and discharge lines used to purge and sample the monitoring wells will be decontaminated between wells using the USAEC-approved water in accordance with Subsections 2.6.1 and 2.6.2.

**2.5.2.5 Groundwater Sample Collection with Screened Hollow Stem Augers.** Screened auger soil borings will be advanced utilizing a 4.25-inch HSA equipped with a five-foot slotted lead auger. If necessary, the slotted auger section may be situated after the lead auger. The slotted auger shall be constructed with either laser slotted openings or wire-wound well screen. In either case the slot size shall not exceed 0.010 inches.

Borehole advancement will be similar to typical HSA soil borings although the cutter head of the auger will be equipped with a bottom plate and therefore no center plug will be needed. Given this arrangement, no soil samples will be collected.

Groundwater sampling equipment for the screened auger sampling program including packer assembly will be decontaminated in accordance with the procedures specified in Subsection 2.6.2.

Upon reaching the specified sampling interval a pump apparatus including a decontaminated submersible pump, a packer assembly and associated tubing and electrical wiring will be lowered into the borehole annulus and positioned at or below the screened auger section. The packer will be situated above the pump to isolate the screened auger from the remainder of the auger flights.

After positioning the pump apparatus the pump will be turned on to begin purging the casing. As the water level begins to fall in the borehole the packer will be inflated to isolate the screened auger interval. Purging will continue until three to five screened auger volumes have been removed from the boring. However, if recovery is poor it may be necessary to abandon the packer assembly and purge the annulus dry.

After purging is complete groundwater samples will be collected directly from the pump outlet. In this case the discharge rate will be reduced to avoid unnecessary agitation of the sample water. Or, if the packer assembly is not utilized the sampling may be conducted with a bailor.

### 2.5.3 Aquatic Macroinvertebrate Sampling

Sampling of aquatic macroinvertebrates is not currently proposed at the MAG-1 Area. However, based on the results of the surface water/sediment sampling this sampling may be required. The aquatic macroinvertebrate sampling is conducted to determine the presence or absence, population density, and taxonomic diversity of macroinvertebrate fauna; to perform statistical community analysis; and to correlate macroinvertebrate community characteristics with concentrations of contaminants found in sediments.

To meaningfully evaluate biological conditions, sampling stations will be selected in comparable habitats (similar water depth and movement, substrate composition, and canopy coverage). Otherwise, community differences resulting from dissimilar physical habitats may be incorrectly attributed to biological degradation from chemical impact.

Typically, at each sampling station one sample and one duplicate sample, each, will be collected from vegetation (phytomacrofauna) and from sediment (benthic infauna). Samples will be collected in standardized unit areas that are clearly marked immediately prior to the commencement of sampling.

Phytomacrofauna will be collected from the water column and from submerged macrophytes with D-frame aquatic dip nets (~600 microns), by sweeping the entire marked water column both vertically and horizontally. The contents of the dip net will be washed into a number 30 USGS brass sieve. Plant matter and other debris will be discarded after removing any attached invertebrates. Material not passing through the sieve will be placed in labeled jars containing approximately 70% ethanol.

Benthic organisms will be collected, using an Eckman dredge or similar sampling device, from sampling stations with silt, muck, or sludge substrates. The dredge contents will be washed through a number 30 USGS brass sieve. Macroinvertebrates and smaller debris not passing through the sieve will be placed in labeled jars

containing approximately 70% ethanol. If necessary, the 70% ethanol preservative will be replaced with fresh preservative to avoid dilution.

For each sampling station, the physical attributes of the aquatic habitat (including nature of the substrate and vegetative characteristics) and water quality parameters (dissolved oxygen, temperature, pH, and conductivity) will be recorded.

All project activities will be performed in accordance with USAEC Quality Assurance/Quality Control, geotechnical, and data management protocols, as well as State of New Jersey and USEPA Region II requirements.

Tables 2-2 through 2-6 are summary tables of the total number of samples collected for chemical and physical analyses. The tables define the analytical method, media type, and number of samples (including QC samples) that will be taken as part of the MAG-1 Area RI/FS.

## 2.6 Decontamination Procedures and Residuals Management

The following subsections outline the decontamination procedures for field investigation equipment and the management of residuals (investigation derived wastes) generated during the RI field program. Decontamination procedures will be performed prior to the equipments first use at the site and at the conclusion of its use at an investigation location. To ensure the effectiveness of decontamination procedures, periodic equipment rinse blanks will be collected and submitted for chemical analysis (see Subsection 4 of the Technical Plan for QA sample schedule).

### 2.6.1 Decontamination of Laboratory Analytical Sampling Equipment

Equipment used for the collection of laboratory analytical samples, including but not limited to split spoon samplers, groundwater bailers, stainless steel spoons, spatulas and bowls as well as sediment core samplers will be properly decontaminated using the following procedure:

- Wash and scrub with Alconox (low phosphate detergent)
- Rinse with USAEC-approved water
- Rinse with 10% HNO3 solution (for carbon steel sampling equipment a 1% $HNO_3$ solution may be used)
- Rinse with USAEC-approved water

- Methanol followed by hexane rinse (pesticide grade or better)
- Deionized water rinse (5 times the volume of solvent used)
- Air dry or nitrogen blow dry
- wrap in aluminum foil (shiny side out)

Surface water samples are collected utilizing laboratory pre-cleaned sample containers and therefore does not require decontamination procedures.

### 2.6.2 Water Pumps

Equipment which is comes in contact with the groundwater but is not used in the direct collection of an analytical sample such as submersible pumps, associated hose, and nondedicated monofilament line for bailers will be decontaminated by the following procedure:

- Wash with approved source water and alconox
- Rinse with approved source water
- Rinse with deionized water (not applicable for screened auger sampling)
- Wrap in clean polyethylene for transport

If disposable equipment, such as nylon rope or hose, are used on a one-time basis these will not require decontamination.

### 2.6.3 Drilling Equipment

Drilling tools (i.e. augers, drill rods) and well screen and riser materials will be decontaminated according to the following USAEC procedure:

- Hot water wash
- High pressure hot water rinse
- Air dry

Augers and drilling equipment will be placed on clean polyethylene sheeting during transport and will be placed on polyethylene sheeting at the drill site.

A field decontamination station will be established to contain all decontamination waste. All decontamination rinse water will be collected and stored in clearly labeled and dated DOT-approved 55 gallon drums at the site. Upon completion of drilling

activities, the containerized water will be disposed of by Ft. Dix, per decision of the NJDEPE and USAEC.

### 2.6.4 Investigation Derived Wastes

The investigation derived wastes produced during the field activities including but not limited to purge water, development water, decontamination fluids, soil cuttings, excess grout, drilling fluids, field laboratory wastes, and personal protective equipment will be containerized in appropriate DOT-approved containers. The drums will be labeled with date, contents, and source (i.e. boring number, or monitoring well number, etc.) and staged according to contents to facilitate proper management. The containers will be disposed of by Ft. Dix as per decision of the NJDEPE and USAEC.

## 2.7 FIELD SCHEDULE

Field activities are scheduled to occur between January 1994 and March 1994. Figure 2-13 is the tentative schedule for field activities.

## 2.8 AQUIFER CHARACTERIZATION

Aquifer testing will be conducted to characterize groundwater flow patterns and to assess aquifer characteristics.

### 2.8.1 Water Levels

The depth to groundwater shall be measured from surveyor's mark on the well riser or, in the absence of such mark, from the highest point on the rim of the well casing or riser. Water level measurements at the various wells will be obtained using an electronic water level meter. The water level will be measured to 0.01 foot. The measured value will be checked by raising the probe 1 to 2 feet and remeasuring the water level to obtain a precise and accurate measurement. The probe end of the water level meter will be decontaminated with the USAEC-approved water between monitoring wells.

The water level elevations will be used to construct groundwater elevation contour maps, from which groundwater flow directions will be interpreted. Vertical hydraulic gradients can be calculated from water level data at well pairs.

### 2.8.2 Hydraulic Conductivity Testing

Permeability testing will be conducted in (1) all new monitoring wells and (2) specific existing wells installed at Ft. Dix, as requested by USAEC. A PVC slug or compressed air will be used to displace water in the well for testing. Compressed air will be used only in wells screened below the water table, and care will be taken not to lower the water table to the depth of the screen. An In-Situ Hermit 1000B or 2000 Datalogger with 10- or 20-pound-per-square-inch transducers, or equivalent, will be used to monitor and record aquifer recovery over time.

Two to three tests will be performed on each well to assess the variations associated with each test, to evaluate the inertial effects associated with each well, and to apply the maximum stress possible at each well. An Aquifer Test Completion Checklist will be completed for each test conducted (Figure 2-14). In addition, a Field Permeability Test Data Sheet will be completed for each test (Figure 2-15).

By observing the behavior of the recovery as a function of time, an estimate of the hydraulic conductivity of aquifer materials surrounding the well can be calculated using the Hvorslev or Bouwer and Rice technique. Should field conditions render hydraulic conductivity tests using slugs ineffective, the following alternate method will be used. A submersible pump will be used to evacuate the well. The discharge rate will be measured and recorded. Two to three separate discharge rates will be selected to adequately stress the aquifer. Changes in water levels will be measured as a function of time during both pumping and recovery. By observing the behavior of the drawdown, discharge, and recovery as a function of time, an estimate of the hydraulic conductivity of the aquifer can be made.

## 2.9 Analytical Procedures for Field Screening Samples

Groundwater samples will be analyzed for selected VOCs and the explosive compound cyclonite (RDX) using field analytical techniques. These field analysis will provide real-time data for use in decisions by on-site personnel. The following subsections describe the field analytical techniques selected for MAG-1 Area.

### 2.9.1 Volatile Organic Compounds

The field analytical protocol for VOCs in groundwater samples is based on USEPA laboratory procedures, where a "purge and trap" sample concentration device is used to achieve detection limits in the 1 to 5 ppb range. The purge and trap process involves purging a measured amount of sample with helium, which strips the VOCs from the sample and then traps them on a polymer trap. This trap is then heated rapidly, transferring the VOCs to the gas chromatography (GC) instrument for separation, identification, and quantitation. The target compounds selected for the MAG-1 Area are TCE, 1,2-dichloroethene (both, cis- and trans-) (12DCE), vinyl chloride (C2H3CL), and carbon tetrachloride (CCL4). Samples will be analyzed using a Hewlett/Packard 5890 Series II GC (or equivalent) equipped with a purge and trap device and an electrolytic conductivity detector. Approximately 20 field samples can be analyzed in a 12-hour period using this procedure. The SOP for this field analytical protocol is provided in Appendix A of this QAPP.

### 2.9.2 RDX

Groundwater samples will be analyzed in the field using enzyme-linked immunosorbent technology. This immunoassay procedure involves a sample tube coated with a material to which an antibody specific to RDX has been linked. When the groundwater sample is introduced to this antibody-treated material, RDX adheres to the antibody, forming an immune complex. A color developer is then added to the sample tube, and the resulting color is inversely proportional to RDX concentration. Samples will be analyzed using an RDX Explosives Test Kit (EM Science or equivalent), and the detection limit will be in the parts-per-billion range. Instructions for use of the test kit are provided in Appendix B of this QAPP.

### 2.9.3 Quality Control for Field Analytical Techniques

QC procedures are established prior to initiation of a field analytical program and implemented throughout sample collection and analysis to ensure that the data generated are adequate for their intended use. The QC program provides information to evaluate data quality and the analytical system performance while not inhibiting the ability to generate daily analytical data, which is the primary goal of field analytical techniques.

The calibration curve for VOCs analysis is generated by analyzing this standard mixture of the target compounds at a minimum of three concentrations.

Concentrations of the compounds detected in field samples are then calculated from this calibration curve. A calibration check standard (a standard with a concentration in the mid-range of the calibration curve) is analyzed daily to ensure the instrument response does not drift. If the results for the calibration check standard are not acceptable, a new calibration curve is generated before any samples are analyzed. See Appendix A for details regarding instrument calibration.

Method blanks (laboratory pure water) are analyzed daily for VOCs to show that the analytical system is free of contamination. Equipment blanks (water which is run through the sampling apparatus) are analyzed to show that cross-contamination is not occurring during sample collection. Cleaning blanks for the GC instrument are also analyzed after any highly contaminated sample to verify that instrument carry-over of contamination is not occurring. See Appendix A for a more detailed discussion of blanks associated with purge and trap analysis.

Spikes (chemicals added at a known concentration to a sample prior to analysis) are used to evaluate the accuracy of the analytical method. A surrogate, a compound that is chemically similar to those being analyzed, is added prior to sample analysis for VOCs to assess recovery (accuracy). Matrix spikes are analyzed as part of the QC program for both VOCs and RDX. A sample is analyzed unspiked to get the baseline concentration. The sample is then spiked with the compounds being analyzed to evaluate their recovery in the actual sample matrix to provide information on potential matrix effects which could affect the analytical result. See Appendix A for more detailed information on spikes and surrogates.

These elements of a QC program allow for the evaluation of the quality and useability of field screening results. Blanks, surrogate spike, and matrix spike analyses provide information on the accuracy of the field screening methods. Duplicate analyses of field samples or of matrix spikes are incorporated into the program to provide information on method precision. These data can be used to show that the analytical system was operating within the required parameters and that the sample results generated are acceptable for use.

# 3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

ABB-ES operates using a multi-disciplinary team-based system. Under this system, personnel representing both engineering and scientific disciplines are assigned to teams and groups organized by similar client focus. The administrative personnel for the Ft. Dix tasks are members of the Department of Defense (DOD) team, which is managed by the Government Programs Group. Task leaders and key technical staff for the Ft. Dix project are assigned to either ABB-ES' DOD team, or other teams within the Government Programs Group. Individuals with specialized skills assigned to other Groups within ABB-ES may join the Ft. Dix project team as needed.

This portion of the QAPP addresses ABB-ES' Ft. Dix project organization, and specifically outlines QC coordination and responsibilities. Those individuals assigned to a project or task are responsible for conducting project work by utilizing the resources assigned to the project management organization. In this way, resources throughout ABB-ES are available to each project, but responsibility for initiating services and for ensuring acceptable results remains within the project organization. This responsibility carries with it the authority to initiate, modify, and, if necessary, stop activities, as appropriate for the assurance of project quality. It is the QA Supervisor's role to assist the Project Manager and Task Leaders in meeting project goals while providing an independent evaluation of product quality to the Program Manager.

Figure 3-1 shows the overall project organization and its principal lines of communication and authority.

## 3.1 QA/QC FUNCTIONAL RELATIONSHIPS

QA is implemented on the Ft. Dix project by means of the USATHAMA Quality Assurance Program, January 1990. The procedures contained in this QAPP adhere to the requirements of the program. Figure 3-2 shows the functional relationships (i.e., lines of authority/ responsibility and communication) for QC and QA for the MAG-1 effort. This figure focuses primarily on the QA/QC organization for the chemical analysis program.

Ultimate responsibility for the quality of data collected in support of USAEC projects rests with the Commander of USAEC and is delegated to the USAEC COR and the Chemistry Branch. Project-specific responsibility for QA/QC within ABB-ES occurs under the supervision of the ABB-ES Project QA Supervisor. The ABB-ES QA Supervisor has authority independent of the Ft. Dix Project Manager and Program Manager to issue corrective actions up to and including cessation of work which is being performed out of compliance with the approved QAPP. The ABB-ES QA Supervisor may require work (e.g., sampling and analysis) to be redone with the concurrence of the U.S. Army Armament, Munitions, and Chemical Command (AMCCOM) Contracting Officer, USAEC COR, and the Chemistry Branch.

The ABB-ES QA Supervisor is supported in monitoring implementation of analytical QC by the ESE Laboratory QA Coordinator (QAC) in accordance with the Ft. Dix QAPP. The Laboratory QA Plan will be incorporated for the Ft. Dix project in its entirety as it relates to analytical QC and the preparation of appropriate sampling containers (see Appendix C). In the fulfillment of QC requirements, the Laboratory QAC provides all QC data to ABB-ES for review, informs the ABB-ES QA Supervisor of any out-of-control situations and corrective actions, and gains concurrence for any corrective actions which cause either schedule slippage or cost growth. Specific duties and responsibilities of personnel relative to the QA/QC are described in the following paragraphs.

## 3.2 Duties and Responsibilities for QA/QC

Specific QA and QC responsibilities for the implementation of the Ft. Dix QAPP have been assigned to QA and management personnel in ABB-ES and ESE. Each member of the ABB-ES technical project team is responsible for performing work in accordance with the approved QAPP and for providing required documentation. Management personnel provide the overall QC documentation, control, and assessment/corrective action. QA and QC personnel provide oversight and review of data quality. The QA/QC duties of each position are identified in the following subsections.

### 3.2.1 USAEC Chemistry Branch, Technical Support Division

The duties of the USAEC Chemistry Branch, Technical Support Division, are as follows:

- advising the Commander on QA/QC practices;
- recommending to the Commander QA practices to be used to support USAEC projects;
- reviewing and approving the QAPP;
- providing standardized analytical methods, as necessary;
- providing analytical reference materials to ESE;
- supplying Target Reporting Limits to the USAEC COR based on the formal list of applicable analytes;
- reviewing and recommending approval of any proposed modifications to analytical methodology;
- recommending certification of ESE analytical methods as necessary prior to collecting field samples;
- providing guidance to the USAEC COR on implementation of QA/QC by ESE;
- providing guidance to the USAEC COR on chemistry matters;
- evaluating the quality of data generated by ESE;
- monitoring the effective implementation of QA/QC and reporting questionable practices to the Commander of USAEC;
- conducting on-site audits of ESE and field sampling activities, if necessary;

- coordinating data reporting requirements with the USAEC Data Management Group.

### 3.2.2 USAEC Contracting Officer's Representative

The duties of the USAEC COR are as follows:

- acting as the principal contact between USAEC, ABB-ES, and Ft. Dix;
- requiring effective implementation of the USAEC QA Program;
- forwarding Chemistry Branch review comments to ABB-ES;
- providing formal notification to the Contracting Officer of unapproved deviations from the QA Program;
- ensuring timely QC chart submission from ABB-ES/ESE on a weekly basis;
- providing a formal list of applicable analytes for this project to the Chemistry Branch and ABB-ES;
- informing the Chemistry Branch of difficulties and problems encountered by ABB-ES in implementing the QA Program;
- discussing proposed changes in approved sampling and analysis procedures with the Chemistry Branch;
- providing ABB-ES' QAPP to the Chemistry Branch for review and approval;
- providing any ABB-ES/Subcontractor Laboratory certification documentation to the Chemistry Branch for review and approval; and
- notifying ABB-ES of certification status.

### 3.2.3 ABB-ES Corporate Officer

The ABB-ES Corporate Officer for the Ft. Dix project is responsible for (1) establishing a contract for the services to be performed and for committing the corporate resources necessary to conduct the program work activities; (2) supplying corporate-level input for problem resolution; and (3) assisting the ABB-ES Program Manager and Project Manager as needed in project implementation.

### 3.2.4 Program Manager

The ABB-ES Program Manager is responsible for the overall USAEC program at ABB-ES. Specific responsibilities of this role include the following:

- overall technical responsibility for the program;
- establishing and overseeing all subcontracts for support services;
- initiating program activities;
- participating in the work plan preparation and staff assignments;
- identifying and fulfilling equipment and other resource requirements;
- monitoring task activities to ensure compliance with established budgets, schedules, and the scope of work;
- regularly interacting with the client regarding the status of the project;
- coordination and review of monthly performance and cost reports (PCR); and
- ensuring that appropriate financial record and reporting requirements are met.

Within the overall technical responsibility for the program, the Program Manager supports the QA Supervisor in the development of the QAPP and the enforcement of its requirements in the implementation of the project. He reviews and resolves conflicts relative to corrective action.

### 3.2.5 Project Manager

The ABB-ES Project Manager is responsible for effective day-to-day management of all operations. The Project Manager has responsibilities which specifically include the following:

- preparing work plans, including approval of monitoring locations, chemical analysis parameters, schedules, and labor allocations;
- managing all funds for labor and materials procurement;
- monitoring and controlling the schedule;
- managing the site team toward unified, productive project accomplishment;
- preparing PCRs;
- direct communication and liaison with the USAEC COR; and
- providing oversight to the technical leaders and reviewing all task deliverables.

Within this framework, the Project Manager supports the ABB-ES QA Supervisor in the development and implementation of the QA Program, and provides resources for review, audit, and corrective action.

### 3.2.6 Functional Leaders

The Functional Leaders include Task Leaders, Site Operations Leader (SOL), and Laboratory/Data Management Leader. They are responsible for the following items:

- the appropriateness, adequacy, and timeliness of the technical or engineering services provided;
- developing the technical approach and level of effort required to address each task/subtask;

- the day-to-day conduct of the work, including the integration of the input of supporting disciplines and subcontractors (i.e., drilling or laboratory subcontractors);
- ongoing QC during performance of the work; and
- the technical integrity as well as the clarity and usefulness of all project work products.

### 3.2.7 Project Review Committee

A key component of ABB-ES' corporate QC policy is the designation of a Project Review Committee (PRC) for each project or task. The members of the PRC are assigned according to the technical functions to be conducted. The function of this group of senior technical and/or management personnel is to provide guidance on the technical aspects of the project. This is accomplished through periodic reviews of the services provided to ensure they (1) reflect the accumulated experience of the firm, (2) are being produced in accordance with corporate policy, and, most importantly, (3) meet the objectives of the program as established by ABB-ES and USAEC.

### 3.2.8 Quality Assurance Supervisor

The ABB-ES QA Supervisor has responsibility for establishing, overseeing, and auditing specific procedures for documenting and controlling analytical and field data quality. Many of the procedures will be implemented by other individuals, but the QA Supervisor must ensure that procedures are being implemented properly and the results interpreted correctly. The QA Supervisor's oversight function includes making unannounced inspection trips to the site to ensure that sampling and laboratory analysis are conducted in a manner consistent with the QAPP, the USAEC QA Program, and other USAEC guidelines. Coordination with the Project Manager prior to the unannounced inspection is acceptable.

In addition, laboratory audits will be coordinated with the USAEC Chemistry Branch. Laboratory procedures will be inspected at least once per task. The visit will occur during the early stages of the sampling effort for each task. Additional inspections may occur at the discretion of the QA Supervisor, with approval of the USAEC COR and ABB-ES Project Manager. The QA Supervisor will document each inspection and ensure that procedures for analysis of each type of matrix (e.g., groundwater,

surface water, soil, and sediment), as described in the QAPP, are followed. The QA Supervisor has the authority to require resampling at any work area where sample integrity was determined to have been affected by faulty sampling procedures, after obtaining concurrence as described earlier in this section.

### 3.2.9 Health and Safety Personnel

The following subsections briefly describe the health and safety designations and general responsibilities that will be employed at Ft. Dix.

**3.2.9.1 Health and Safety Supervisor.** The Health and Safety Supervisor (HSS) for ABB-ES will be responsible for (1) approval of the individual chosen to serve as the site Health and Safety Officer (HSO) for this field operation; (2) review and approval of the HASP, as well as, any significant changes made over time to the HASP; (3) oversight of the daily efforts of the HSO; (4) resolution of site disputes involving health and safety issues; and (5) implementation of the HASP by the HSO.

**3.2.9.2 Health and Safety Officer.** The HSO for the MAG-1 Area will be Paul Bolmer. The HSO is responsible for implementing this site-specific HASP in accordance with the ABB-ES Health and Safety Program. The HSO will conduct safety inspections and investigate all accidents, illnesses, and incidents occurring on-site. The HSO will also conduct safety briefings and site-specific training for on-site personnel. As necessary, the HSO will accompany all USEPA, OSHA, or other governmental agency personnel visiting the site in response to health and safety issues. The HSO, in consultation with the HSS, is responsible for updating and modifying this HASP as site or environmental conditions change.

The HSO is vested with the authority to stop site operations (STOP WORK AUTHORITY) if he determines that an imminent health or safety or other potentially dangerous situation exists. The HSO is to immediately notify the HSS of any Stop Work Orders issued. The HSO may also recommend to the HSS that the downrange authorization of individual site personnel be revoked for health and/or safety reasons.

### 3.2.10 Laboratory Program Manager

The ESE Program Manager will provide direction to the analysts at ESE and is responsible for implementing the USAEC QA Program. His major responsibilities include:

- supporting the efforts of the ESE Laboratory QAC to ensure that the USAEC QA Program is being properly implemented;

- providing sufficient workspace, instrumentation, resources, and personnel to conduct all analyses according to the USAEC QA Program requirements;

- overseeing that all purchased chemicals (i.e., standards, solvents, and reagents) are checked for proper identity and adequate purity; and

- ensuring the implementation of any corrective actions which might be deemed necessary for any QA/QC deficiencies.

### 3.2.11 Laboratory Quality Assurance Coordinator

The ABB-ES QA Supervisor and Project Manager will delegate implementation of analytical QC functions as appropriate to the ESE Laboratory QAC. His major activities in the continued implementation of the USAEC QA Program at ESE include the following:

- monitoring the QA/QC activities of the laboratory to ensure conformance with the established protocols and good laboratory practices, as appropriate;

- informing the Laboratory Program Manager, individual analysts, and ESE corporate management, as appropriate, of nonconformance to the QA Program and recommending corrective actions which would reestablish conformance with the requirements of the QA Program;

- requesting the appropriate Standard Analytical Reference Materials from USAEC upon receipt of delivery orders;

- ensuring that all documents pertaining to the MAG-1 Area effort (i.e., records, logs, standard procedures, project plans and analytical results) are maintained in a retrievable fashion and distributed to the appropriate personnel;

- establishing, with the analysts, the proper analytical lot size for daily analysis and correct daily QC samples to be included in each lot

according to the established procedures for evaluating acceptable, in-control analytical performance (i.e., initial and daily calibration and appropriate control charts);

- establishing, with the designated sample custodian, that samples received in the laboratory are logged in properly, the appropriate analytical lot size established, and sample numbers for the QC samples allocated in the correct manner;
- ensuring that analysts are preparing the proper QC samples, maintaining control charts, and implementing any recommended corrective actions;
- ensuring that instrument logs and QC documents are being maintained with all the required information documented;
- collecting control charts from the analysts, discussing the results with the analysts and Laboratory Program Manager, and submitting these control charts to ABB-ES on a weekly basis;
- reviewing all laboratory data prior to the reporting of data to other project participants; and
- maintaining an awareness of the entire laboratory operation for adherence to the procedures specified in the USAEC QA Program.

Additional responsibilities of the Laboratory QAC are detailed in the USAEC QA Program (USATHAMA, 1990) and the Laboratory QA Plan (Appendix C).

# 4.0 QUALITY ASSURANCE OBJECTIVES

Data quality objectives (DQOs) have been developed for the MAG-1 Area to provide that data collected during the field investigation will be of sufficient quality to support subsequent decision-making during the RI/FS process. Specific objectives have been addressed in the applicable Task Order Work Plans and subsequently in the development of this QAPP. Site-specific questions such as how the data will be used and how much data are required were addressed during development of the DQOs. In addition, the required data quality was addressed to indicate the magnitude of error that could be tolerated by the data-user.

## 4.1 GENERALIZED SCOPE OF WORK

The RI/FS field efforts will involve several activities relative to the acquisition of chemical data. Each investigation will involve a task-based approach that will allow the decision making process to modify future data gathering tasks. Screened HSA sampling and field GC analyses will, in some instances, be the initial chemical data gathering task. The results of field analysis will be used to confirm or modify the proposed locations of soil and/or groundwater sample collection. The analytical DQOs for the screened HSA sampling will be applicable to meeting this decision-making objective. The DQOs for soil, groundwater, and surface water and sediment sample collection and analysis will be applicable to the confirmation of the presence or absence of contamination and the nature and extent of any contamination encountered in those media. Additional analytical DQOs include determining risks of exposed populations and selecting remedial alternatives for contaminated media at the MAG-1 Area.

## 4.2 DATA QUALITY OBJECTIVES

DQOs are qualitative or quantitative statements developed by the data user to specify the quality of data needed from a particular data activity to support specific decisions. The DQOs are the starting point in the design of the investigation. The DQO development process matches sampling and analytical capabilities to the data targeted for specific uses and ensures that the quality of the data does not underestimate project requirements. The USEPA has identified five general levels of analytical data quality as being potentially applicable to field investigations

conducted at potential hazardous waste sites under CERCLA. These levels are summarized as follows:

- Level I - Field Screening. This level is characterized by the use of portable instruments which can provide real time data to assist in the optimization of sampling point locations and for health and safety support. Data can be generated regarding the presence or absence of certain contaminants (especially volatiles) at sampling locations.

- Level II - Field Analysis. This level is characterized by the use of portable analytical instruments which can be used on-site or in mobile laboratories stationed near a site. Depending on the types of contaminants, sample matrix, and personnel skills, qualitative and quantitative data can be obtained.

- Level III - Laboratory analysis. This level is characterized by the use of methods other than the Contract Laboratory Program (CLP) Routine Analytical Services (RAS). This level is used primarily in support of engineering studies using standard USEPA-approved procedures. Some procedures may be equivalent to the USEPA CLP RAS, without the CLP requirements for documentation.

- Level IV - CLP RAS. This level is characterized by rigorous QA/QC protocols and documentation, which provide qualitative and quantitative analytical data.

- Level V - Non-standard methods. This level includes analyses which may require modification and/or development. CLP Special Analytical Services (SAS) and analyses for explosives are considered Level V.

For the MAG-1 Area, field measurements such as pH, temperature, specific conductance, and readings from an organic vapor analyzer (OVA) or HNu photoionization detector, MSA Model 260 $0_2$/Explosimeter, and Draeger tubes will constitute Level I field analytical data. More sophisticated instrumentation (such as the Photovac 10S 50, OVA in GC mode) used for on-site analysis of volatiles, inorganics, etc., will be considered as Level II analytical data, supported by more extensive logbook documentation, calibration, and quality control.

Analysis for water quality parameters and other parameters where specific USAEC guidelines are not applicable will constitute Level III data.

Analysis for Project Analyte List (PAL) (See Section 6.0) organics, inorganics, and polychlorinated biphenyls (PCBs) will be considered approximately equivalent to USEPA analytical support Level IV quality data. That is, all data will be generated according to USAEC guidelines, which is the same level of quality and documentation as Region II CLP protocol.

Analyses for explosive compounds in groundwater and soil, using high pressure liquid chromatography, will be considered approximately equivalent to USEPA Level V quality data.

The sampling approaches presented in Section 5.0 of this QAPP and the laboratory analytical procedures described in Section 6.0 and Appendix C have been selected to meet the applicable data quality objectives.

## 4.3 QA/QC APPROACH

The approach to providing reliable data that meets the DQOs will include QA/QC requirements for each of the chemical data types generated during the field investigation. The details of field analytical QA/QC are included in Appendices A and B of this QAPP. The QA/QC efforts for laboratory analyses will include collection and submittal of QC samples and the assessment and validation of data from the subcontract laboratories.

DQOs are based on the premise that different data uses require different levels of data quality. Data quality refers to a degree of uncertainty with respect to precision, accuracy, representativeness, completeness, and comparability. Specific objectives for these characteristics are established to develop sampling protocols and identify applicable documentation, sample handling procedures, and measurement system procedures. These DQOs are established on site conditions, objectives of the project, and knowledge of available measurement systems.

**Precision and Accuracy** -- Precision is defined as the level of agreement among repeated measurements of the same parameter. The overall precision of data is a mixture of sampling and analytical factors. Field precision will be expressed as relative percent difference (RPD) of field duplicates, where:

$$\text{RPD} = \frac{|X1 - X2|}{(X1 + X2)/2} \times 100$$

where:

| | | |
|---|---|---|
| RPD | = | relative percent difference between duplicate results |
| X1 and X2 | = | results of duplicate analyses |
| \|X1 - X2\| | = | absolute difference between duplicates X1 and X2 |

Field duplicates take into account the level of error introduced by field sampling techniques, field conditions, and analytical variability. The RPD of field duplicates will be calculated by ABB-ES in order to evaluate the sample precision.

Laboratory precision will be determined in accordance with the procedures outlined in "USATHAMA Quality Assurance Program", January 1990.

Accuracy is defined as the degree to which the analytical measurement reflects the true concentration level present. Accuracy will be measured as percent recovery for matrix spikes.

A matrix spike is a sample (of a particular matrix) to which predetermined quantities of standard solutions of certain target analytes are added prior to sample extraction/digestion and analysis. Samples are split into replicates, one replicate is spiked and both aliquots are analyzed.

Accuracy can also be evaluated using the recovery of surrogate spikes in the organic analyses. These spikes consist of organic compounds which are similar to the analytes of interest in chemical composition, extraction, and chromatography, but which are not normally found in environmental samples. These compounds are spiked into all blanks, standards, and samples prior to analysis.

Percent recoveries of the surrogate, blank spike, and matrix spikes will be reported by the laboratory for all analytes associated with the samples. Variations from 100 percent recovery may be due to matrix interferences, laboratory spike handling procedures, or sample heterogeneities between replicates. The percent recovery of the spikes can be calculated from the following equation:

$$\%\ recovery = \left(\frac{X-B}{T}\right) x\ 100$$

where: X = measured amount in sample after spiking
B = background amount in sample
T = amount of spike added

Accuracy is difficult to evaluate for the entire data collection activity, especially the sampling component. Field and trip blanks will be used in addition to the matrix and surrogate spiked samples to evaluate data accuracy in the investigations.

Accuracy of field measurements will be qualitatively controlled through the use of SOPs which have been developed to standardize the collection of measurements and samples. Consistent proper calibration required of all equipment throughout the field exercises will assist in the accuracy of measurements.

**Representativeness** -- Representativeness is defined as the degree to which the data accurately and precisely represents the medium being sampled. Sampling protocols have been developed to assure that samples collected are representative of the media. Field handling protocols (e.g., storage, handling in the field, and shipping) have also been designed to protect the representativeness of the collected samples. Representativeness of samples will be achieved to the greatest degree possible by adhering to the applicable Technical Plan and the sampling procedures described in Section 2.0.

**Completeness** -- Completeness is a measure of the amount of information that must be collected during the field investigation to allow for successful achievement of the objectives. The QA objective for this project is to obtain acceptable data for all samples collected. Completeness will be evaluated by carefully comparing project objectives with the proposed data acquisition and resulting potential shortfalls in needed information. Completeness equals the number of accepted data points/the number of planned data points.

**Comparability** -- Comparability expresses the confidence with which one set of data can be compared with another. Quantitatively, comparability can be assessed in terms of the precision and accuracy of two sets of data. Qualitatively, data subjected to strict QA/QC procedures will be deemed more reliable than data obtained

without the use of these procedures. To maintain comparability, proper sampling methods, COC protocols, USAEC-certified analytical methods, and strict QA/QC procedures will provide the basis for uniformity in all data collection and analysis activities. Field documentation will be used to establish that protocols for sampling and measurement follow appropriate SOPs.

## 4.4 LEVELS OF CONCERN

An integral part of the identification of DQOs is the determination of Levels of Concern (LOC), used as a basis for detection limit requirements. LOC are developed solely to ensure that the chosen analytical methods have detection limits which are low enough to achieve compliance with Applicable, Relevant, and Appropriate Requirements (ARARs), Guidance "To Be Considered" (TBCs), or Practical Quantitation Limits (PQLs) established by NJDEPE. Discussion of ARARs and their applicability to remediation is discussed in Section 9.0 of the Technical Plan which has been included with this submittal.

In the development of LOC, all chemicals proposed for analysis at the MAG-1 Area were compared with ARARs, TBCs, and/or PQLs. The laboratory chosen to provide chemical analytical support will be required to have detection limits at or below the LOC.[3] This section briefly discusses the regulations and guidelines involved in the identification of LOC for groundwater, soil, sediment, and surface water media.

### 4.4.1 Levels of Concern in Groundwater

The groundwater at Ft. Dix is classified as Class I-Pinelands (PL) (ICF QAPP, 1993), regulated under the jurisdiction of the Pinelands Commission, defined by the Pinelands Protection act of 1979. Class I-PL is identified as nearly synonymous to Class GW1 (NJDEPE, 1991b). These groundwater classifications served as the basis for the development of LOC for groundwater at the MAG-1 Area.

As described in the Proposed New Rule for Cleanup Standards at Contaminated Sites, prepared by the NJDEPE Site Remediation Program, natural groundwater quality (i.e., background) has been defined as the cleanup standard for Class I-PL groundwater (NJDEPE, 1991b). The numeric criterion for any synthetic organic

[3]In select instances the method detection limit is slightly greater than the LOC.

contamination that is not a result of natural processes is zero. However, because no current laboratory methods exist which can reliably measure to zero or even to health-based and ecological-based concentrations for many of the carcinogens, the PQLs[4] are used to measure compliance, and are considered the LOC.[5] The use of the GW-1 PQL as a LOC is supported by the regulation in the New Jersey Ground Water Quality Standard (N.J.A.C. 7:9-6(c)) which states "Where a constituent standard (the criteria as adjusted by the anti-degradation policy and applicable criteria exceptions) is of a lower concentration than the relevant PQL, the Department shall not (in the context of an applicable regulatory program) consider the discharge to be causing a contravention of that constituent standard so long as the concentration of the constituent in the affected ground water is less than the relevant PQL".

For inorganics, "natural background" concentrations will also be considered as LOCs. "Natural inorganic background" concentrations will be established for groundwater by means of analytical results obtained from "background" groundwater monitoring wells and published regional background data. The range of values observed for inorganic constituents in samples drawn from each of the background wells and from published regional background data will be considered the natural range of concentrations expected for that element in groundwater. Analytical results greater than the upper limit of the range for that constituent would be considered "above background".

USAEC performance demonstrated methods with either certified reporting limits (CRLs) or criteria of detection (CODs) which meet the LOC (GW-1 PQL) will be used for the analysis of the applicable constituents. If the LOC cannot be achieved by the USAEC CRL or COD, a non-USAEC method with the lowest method detection limit (MDL), capable of achieving the GW-1 PQL will be used in these select cases. The groundwater LOCs and associated methodologies are presented in Tables 4-1 and 4-2.

[4]The PQL is the lowest concentration of a constituent which can be reliably measured on a routine basis within acceptable levels of precision and accuracy.

[5]PQLs have been established as levels of compliance for this site by the NJDEPE and the Pinelands Commission.

### 4.4.2 Levels of Concern in Soil

The LOC concentrations for soils presented in Tables 4-3 and 4-4 were obtained from the proposed rule entitled Cleanup Standards for Contaminated Sites developed by NJDEPE (NJDEPE, 1991b), N.J.A.C. 7:26 D. Note that these values will be used as screening criteria only, a risk assessment will be performed with collected data. Ecological impacts and other site specific factors including background conditions may result in site specific cleanup criteria which differ from the LOC listed in the table. Note that there are three soil cleanup criteria: residential direct contact, non-residential direct contact, and impact to groundwater. Ft. Dix is classified as non-residential with a standard industrial classification of 9711. Therefore, the LOC concentrations in the tables are the lowest concentration between the non-residential direct contact and impact to groundwater.

In addition, "natural background" concentrations of inorganics in soils will be considered as LOCs. "Natural inorganic background" concentrations ranges are currently being established for soils by the USAEC Environmental Investigation/Alternative Analysis at Fort Dix and are also available in published regional background data. Analytical results greater than the upper limit of the range for that constituent would be considered "above background."

### 4.4.3 Levels of Concern in Surface Water

The State of New Jersey has established the numeric criterion for any synthetic organic contamination that is not a result of natural processes is zero in surface water. However, because no current laboratory methods exist which can reliably measure to zero or even to health-based and ecological-based concentrations for many of the carcinogens, the PQLs[6] are used to measure compliance, and are considered the LOC.[7] The surface water LOCs are presented in Tables 4-5 and 4-6.

For inorganics, "natural background" concentrations will also be considered as LOCs. "Natural inorganic background" concentrations are currently being established for

[6]The PQL is the lowest concentration of a constituent which can be reliably measured on a routine basis within acceptable levels of precision and accuracy.

[7]PQLs have been established as levels of compliance for this site by the NJDEPE and the Pinelands Commission.

surface water as part of the Ft. Dix Environmental Investigation/Alternatives Analysis. Data are also available in published regional background data. The range of values observed for inorganic constituents in background samples and from published regional background data will be considered the natural range of concentrations expected for that element in groundwater. Analytical results greater than the upper limit of the range for that constituent would be considered "above background."

USAEC performance demonstrated methods with either CRLs or CODs which meet the LOC (SW PQL) will be used for the analysis of the applicable constituents.

#### 4.4.4 Levels of Concern in Sediments

The sediment LOCs presented in Tables 4-7 and 4-8 were obtained from screening level values from a summary document prepared by the National Oceanic and Atmospheric Administration (NOAA 1990); "The Potential for Biological Effects of Sediment-sorbed Contaminants Tested in the National Status and Trends Program". This report was found in NJDEPE's Guidance for Sediment Quality Evaluations (March 1991a). This report assembled and reviewed currently available information in which estimates of chemical concentrations in sediment associated with adverse biological effects. Two values were statistically calculated: an Effects Range-Low (ER-L), a concentration at the low end of the range in which effects had been observed and an Effects Range-Mid (ER-M), a concentration approximately midway in the range of reported values associated with biological effects.

In addition to the sediment LOCs presented in Tables 4-7 and 4-8, there is sediment quality criteria for selected organic compounds based upon an equilibrium partitioning approach (USEPA 1988) found in NJDEPE's Guidance for Sediment Quality Evaluations (March 1991a). This theoretical model is based upon the partitioning of non-polar organic contaminants between sediments and interstitial water. Distribution coefficients for individual contaminants are used to establish chemical concentrations in sediments that will yield concentrations in interstitial waters that are equivalent to ambient water quality criteria for the protection of aquatic life. The partitioning between sediments and water is dependent on the organic content of the sediment.

Mean, lower, and upper confidence limits have been established for the sediment quality criterion for each compound in freshwater. The lower confidence limit represents a concentration below which no adverse impacts are expected with 95%

certainty (USEPA 1988). NJDEPE suggests the use of the lower confidence limit in pristine or particularly sensitive environments, such as the Pinelands. The total organic carbon (TOC) concentration is multiplied by the lower confidence limit to calculate the computed sediment criterion. The sediment samples collected at The MAG-1 Area will be analyzed for TOC to calculate the sediment quality criterion. The lower confidence limits are presented in Table 4-9.

"Natural background" concentrations of inorganics in sediments will be considered as LOCs. "Natural inorganic background" concentration ranges are currently being established by ICF (ICF, 1993) for sediments and are also available in published regional background data. Analytical results greater than the upper limit of the range for that constituent would be considered "above background."

### 4.5 Blank Contamination Assessment

Although all analytical data are reported to USAEC, a blank contamination assessment will be performed to determine the impact of contaminant contributions. These potential sources include field sampling procedures, sample shipment, and the laboratory environment. Potential cross-contamination during sample collection and shipment, and in the laboratory, will be assessed through the evaluation of field blanks. Field blanks are created from "demonstrated analyte-free" water which is water of known quality and does not contain any of the analytes of interest to the project which are greater than USAEC CRLs or USEPA detection limits associated with the methodology used at this site. It should be noted that these concentrations are lower than the USEPA Contract Required Detection Limits (CRDLs) from the USEPA Contract Laboratory Program and Contract Required Quantitation Limits (CRQLs) and therefore define the criteria for the analyte-free water. These blanks are transported with the environmental samples to the laboratory. Field blanks consist of rinse blanks that are generated in the field by the sampling crew, and trip blanks that are supplied to the sampling team by the laboratory. In addition, method blanks are used to determine the potential contamination from the laboratory environment and analytical method used to process the sample. Following the qualification of data, the USAEC project officers and the USAEC project QA chemist will evaluate the usefulness of the qualified data and will either decide to resample and reanalyze or will decide to use the data in the qualified state.

Potential sample contamination contributed by the laboratory environment will be discerned through the evaluation of the laboratory method blanks. Method blanks

will be processed at the beginning of each analytical run by the laboratory to determine whether the internal laboratory environment, reagents used during analyses, analytical techniques, or the instrumentation system are sources of contamination that could affect the integrity of the sample. The criterion for the evaluation of blank contamination applies to any blank associated with the samples and states that no contamination should be in the blank. If contamination is detected, all data associated with the blank will be carefully evaluated to determine if there is an inherent variability in the data for the lot, or if the problem is an isolated occurrence not affecting all samples in the lot. In cases where more than one blank is associated with a given sample, qualification will be based upon a comparison with the associated blank having the highest concentration of the contaminant. Data usability as a result of qualifications from blank contamination will be assessed during the risk assessment phase.

# 5.0 SAMPLING

Sample identification, sample labeling, container requirements, preservation, sample collection, sample custody, and field calibration are described in this section. Procedures described are designed to eliminate external contamination and to ensure data quality.

## 5.1 SAMPLE IDENTIFICATION AND LABELING

### 5.1.1 Sample Identification System

The sample identification system developed for this RI effort enables unique sample identification to be applied to each sample collected. The system has been developed to be consistent with the requirements of Installation Restoration Data Management Information System (IRDMIS) and, to the extent practicable, with the previous sampling efforts at Ft. Dix. Each exploration location will be assigned a unique identifier (the "Site ID"). However, as many explorations will have more than one analytical sample collected, a unique identifier will also be assigned to each sample (the "field sample number"). The field sampling number will serve as the principle analytical data tracking identifier. The protocols for assigning Site IDs and field sampling numbers is described below.

### 5.1.2 Site ID

The following protocols are used for assigning Site IDs. Each Site ID consists of three to seven alpha-numeric characters and one hyphen (e.g., TP-1). The first character field is composed of two to five letters which indicates the type of sample as follows:

| | |
|---|---|
| test pits samples | TP |
| soil boring samples | SC |
| groundwater samples (monitoring well) | MAG |
| groundwater samples (screened auger) | SCAUG |
| sediment samples | SE |
| surface water samples | SW |
| underground storage tank samples | USTL |
| septic tank samples | SEPL |

| | |
|---|---|
| investigation derived waste samples | IGW |

This field is followed by a hyphen.

The hyphen is followed by a one to three character field composed of numbers which specify the exploration number (e.g., 13 indicates exploration number 13).

Monitoring well samples have one final character which indicates the relative depth of the monitoring well (A indicates a shallow well, B indicates an intermediate well, and C indicates a deep well).

### 5.1.3 Field Sampling Number

The field sampling number is a unique identifier individually assigned to each analytical sample. The field sampling number includes the Site ID information as well as sample depth and QA/QC information. The maximum number of alpha-numeric characters in the field sample number is eight (e.g., P00101LX). The following protocols are utilized to assign field sampling numbers.

The first character is a single letter which designates the type of sample as follows:

| | |
|---|---|
| test pit samples | P |
| soil boring samples | S |
| groundwater samples (monitoring wells) | G |
| groundwater samples (screened augers) | A |
| sediment samples | D |
| surface water samples | W |
| liquid waste (UST/septic tank) samples | L |
| investigation derived waste samples | I |

The second through the fourth characters are numbers which specify the exploration number (e.g. 004 indicates exploration number 4 and 303 indicates exploration number 303).

In monitoring wells the fifth through the eighth characters in the field sampling numbers are completed as follows:

> The fifth character is a letter which indicates the relative depth of the monitoring well as follows:

| | |
|---|---|
| shallow wells | A |
| intermediate wells | B |
| deep wells | C |

The sixth character is a letter which indicates if the sample is filtered or total (F indicates filtered, X indicates total).

The seventh character is a letter which indicates if the sample is to be submitted to the analytical laboratory (L) or the field laboratory (F).

The eighth character is a letter which indicates if the sample is a duplicate (D) or not (X).

In all other explorations (soil borings, test pits, surface waters/sediments, etc.) the fifth through the eighth characters  the field sampling number are completed as follows:

The fifth and sixth characters are numbers which indicate depth of the sample in feet bgs.

The seventh character is a letter which indicates if the sample is to be submitted to the analytical laboratory (L) or the field laboratory (F).

The eighth character is a letter which indicates if the sample is a duplicate (D) or not (X).

## 5.2 Containers

In general, sample container selection will be based on the following standards for water:

- septum-sealed glass vials for volatile compounds;
- amber glass bottles with Teflon®-lined lids for organic constituents other than volatiles; and
- polyethylene bottles for inorganic analytes.

For soil and sediment samples, wide-mouth amber glass bottles shall be used. All sample bottles will be prepared in accordance with the procedures specified in Appendix F of the USATHAMA QA Program (USATHAMA, 1990). A summary of specific containers and required sample volumes is provided, by analysis, in Tables 5-1, 5-2, and 5-3 along with preservation and holding time requirements. Sample preservation requirements are set forth in detail by USATHAMA (USATHAMA, 1990, Section 6.9 and Appendix H).

### 5.3 SAMPLE PRESERVATION

Preservatives will be required to retard biological action during transit and storage prior to laboratory analysis. Preservatives will be added to appropriate samples at the time of collection. The types of preservation required for samples collected during this project are contained in Tables 5-1 (aqueous), Table 5-2 (soil), and Table 5-3 (physical). In addition to chemical preservatives, all samples for chemical analysis will be transported to the laboratory in temperature controlled coolers. Blue ice or wet ice will be used to maintain the internal cooler temperature at $4°C\pm2°$ which is required for preservation. If the temperature is outside this range the USAEC COR and/or Project Chemist will be notified. Procedures for chemical sample preservation for analyses other than USEPA target compound list (TCL) VOCs are described below:

1. Preservatives will be added to samples either using a pipette or directly to the sample if vials of preservatives are used.

2. The sample bottle will be capped, and the bottle gently agitated in order to homogenize the preservative throughout the sample.

3. The sample bottle cap will be reopened and a small amount of the sample will be transferred to a beaker and the bottle will be closed.

4. Either pH paper or an electronic pH meter will be used to determine the pH of the sample, where applicable. pH paper or a pH meter will never be put directly into the sample bottle in order to avoid contamination from entering or leaving the sample.

5. If the proper pH has been reached (where applicable), the sample bottle will remain closed. If the proper pH has not been reached, the

sample bottle will be reopened, more preservative added, the bottle shaken, and the pH tested until the proper pH has been reached.

Samples to be analyzed for USEPA TCL VOCs will be preserved by addition of the correct volume of 1:1 hydrochloric acid (HCL). The correct volume of preservative will be determined by preparing a "dummy" sample and determining the number of drops of 1:1 HCL required to lower the pH to 2. This number of drops of 1:1 HCL will then be added to each VOC vial prior to the addition of the groundwater sample. If effervescence occurs upon addition of the 1:1 HCL (resulting in partial loss of VOCs), the sample will be submitted without preservation, except for cooling to 4 degrees Celsius and the holding time will be reduced to seven days. The absence of preservative in the sample will be clearly stated on the entry of the chain of custody form for that sample.

## 5.4 SAMPLE COLLECTION

Procedures for the collection of samples are provided in Subsection 2.5, and are summarized in the Technical Plan, and thus will not be discussed further in this document. Collection of all samples will follow standard USEPA and USAEC protocols. This section discusses the collection of quality control samples.

### 5.4.1 Quality Control Samples Collected in the Field

Field operations performed during the RI/FS at the MAG-1 Area will include the collection of several types of quality control samples. These samples will include trip blanks and field blanks.

Trip blanks are required for assessing the potential for contaminating samples with VOCs during sampling, transit, and storage. The trip blank consists of a VOC sample container which is filled at the laboratory and shipped to the site with the other VOC sample containers. A trip blank will be included with each shipment of water samples scheduled for VOC analysis and will be stored and analyzed with the corresponding VOC samples.

VOCs, SVOCs, or inorganics present within or on soil sampling apparatus where intimate contact with the sample occurs (i.e. split-spoon, trowel, spatula, bailers, etc.) are assessed by rinsing the sampling apparatus with USAEC-approved water following decontamination. These equipment rinsate blanks are water samples

collected directly into the appropriate bottle for each parameter. Two rinsate blanks will be collected for the MAG-1 Area field program: one for aqueous sampling apparatus (i.e. bailers) and one for soil/sediment sampling apparatus (i.e. split-spoons, trowels, spatulas, and aluminum mixing pans).

See Tables 2-2 through 2-6 for breakdown of quality control samples to be collected during the MAG-1 field program.

### 5.5 Sample Custody Procedures

ABB-ES has established a program of sample tracking and COC that is followed during sample handling activities in both field and laboratory operations. This program, which is compatible with USAEC and USEPA COC programs, is designed to assure that each sample is accounted for at all times. To maintain this level of sample monitoring, computer-generated sample container labels, shipping seal manifests, and COC forms are employed as necessary. Field data sheets, COC records, and analytical request forms (ARFs) are also completed by the appropriate sampling and laboratory personnel for each sample.

The objective of the sample custody identification and control system is to ensure that:

- samples are uniquely identified;
- samples are collected for all scheduled analyses;
- the correct samples are analyzed for requested analyses and are traceable to their records;
- descriptions of important sample characteristics and field observations are recorded;
- samples are protected from loss and identified if damaged;
- alteration of samples (e.g., filtration and preservation) is documented;
- a forensic record of sample integrity is established;

- sample security is maintained; and
- relevant field information is recorded including location, sample number, date and time, identification of field samples, and individuals collecting the samples.

### 5.5.1 Field Custody

The COC protocol followed by the sampling crews involves the following steps:

- documenting procedures used and reagents added to samples during sample preparation and preservation;
- recording sample locations, sample site identification, field sample number, and specific sample collection procedures on the appropriate forms;
- using pre-prepared sample labels that contain all information necessary for effective sample tracking;
- securing a signed and dated custody seal over the sample container lid; and
- completing standard field data record forms to establish sample custody in the field before sample shipment (see Section 2.0).

Prior to sampling, labels are developed for each sample to be collected. Each label is numbered to correspond with the appropriate sample(s) to be collected. A two part sample identification system has been established for the MAG-1 Area Sampling Program. Samples will be identified using a sample site identifier. A summary of the labels prepared, with space for sample tracking and notations, is also printed. This sample manifest assists sample control in the field and is eventually retained as part of the project file. Examples of pre-prepared labels and sample manifests are shown on Figures 5-1 and 5-2.

The COC record is used to document sample-handling information (i.e., sample location, sample identification, and number of containers corresponding to each sample number). The following information is recorded on the COC record:

- project reference;
- the site location code, sample identification number, date of collection, time of collection, sample bottle number, preservation, and sample type, number of containers, sample matrix;
- the names of the sampler(s) and the person shipping the samples;
- serial number of custody seals and shipping cases;
- the date and time that the samples were delivered for shipping;
- analyses required; and
- the names of those responsible for receiving the samples at the laboratory.

An example of a COC and an ARF are shown in Figure 5-3 and 5-4. Field sample data records, which also include pertinent data relative to COC procedures were presented in Section 2.0 (see Figures 2-7, 2-9, and 2-11). The COC and ARF are completed in triplicate. One copy accompanies the samples to the laboratory, another is kept by the sample crew chief and transferred to the Laboratory QAC, and the last copy is maintained in the project file.

### 5.5.2 Sample Shipments

Sample containers are generally packed in metal or hard plastic, insulated coolers for shipment. Bottles are packed tightly so that no motion is possible. Styrofoam, vermiculite, and "bubble pack" are used to protect bottles from breaking. Blue ice packs, or Ziploc® bags containing ice, are added to the cooler along with all paperwork. The paperwork (i.e., COC forms and ARFs) is sealed in a separate Ziploc® bag and placed in a prominent position inside. The cooler top is then taped shut and all openings are sealed with evidence tape.

The standard procedure followed for shipping environmental samples to the analytical laboratory is as follows:

- Shipping of environmental samples collected by ABB-ES personnel is done daily through Federal Express or equivalent overnight delivery

service with the exception of Saturday and Sunday. Samples collected on Saturday and Sunday will be held for shipment on Monday. Receipts are retained as a part of the COC documentation.

- Prior to leaving for the field, the ABB-ES SOL notifies the Laboratory/Data Management Leader of the number, type, and approximate collection and shipment dates for the samples. If the number, type, or date of shipment changes due to program changes, the SOL must notify the Project Manager and Laboratory/Data Management Leader of the changes. This notification from the field also needs to occur when sample shipments will arrive on Saturdays. The SOL will coordinate sample pick-up with the laboratory.

- If prompt shipping and laboratory receipt of the samples cannot be guaranteed (e.g. Sunday arrival), the samplers will be responsible for proper storage and custody of the samples until transportation or shipment arrangements can be made.

- The SOL must notify the appropriate laboratory when samples collected by field sampling teams are going to be shipped to the laboratory.

The Laboratory/Data Management Leader keeps the laboratory and the ABB-ES Project Manager informed of all field sampling activities. This communication is critical to allow the laboratory enough time to prepare for the sample shipment arrival and to keep the Project Manager current on the status of the sampling program.

During sampling, field samples are brought to a central sample collection location. The COC and ARFs are initiated upon receipt of the samples and sample data records at the collection point. Once the COC form is initiated, when transferring possession of the samples, each transferee will sign and record the date and time on the COC record. Custody transfers, if made to a sample custodian in the field, should account for each individual sample, although samples are transferred as a group. Every person who takes custody will fill in the appropriate section of the COC record. To prevent undue proliferation of custody records, the number of custodians in the chain of possession will be kept as small as possible.

### 5.5.3 Laboratory Custody

COC procedures are also necessary in the laboratory from the time of sample receipt to the time the sample is discarded. The following procedures will be implemented by the laboratory subcontractor:

- A specific person, the Laboratory QAC, is designated custodian; an alternate designee may act as custodian in the Laboratory QAC's absence. Incoming samples will be received by the custodian, who will indicate receipt by signing the accompanying custody forms and who will retain the signed forms as permanent records.

- The sample custodian maintains a permanent logbook to record for each sample, the person delivering the sample, the person receiving the sample, the date and time received, the source of the sample, the sample identification or log number, how the sample was transmitted to the laboratory, and the condition received (i.e. sealed, unsealed, broken container, or other pertinent remarks). A checklist in a standardized format is used for logbook entries.

- A clean, dry, isolation room, building, and/or refrigerated space that can be securely locked from the outside will be designated as a "Sample Storage Security Area."

- The custodian ensures that heat-sensitive, light-sensitive, radioactive, or other samples having unusual physical characteristics or requiring special handling are properly stored and maintained prior to analysis.

- Distribution of samples to individuals who are responsible for performing the analysis is made only by the custodian.

- Laboratory personnel are responsible for the care and custody of the sample once it is received by them and will be prepared to testify that the sample was in their possession and view or secured in the laboratory at all times from the moment it was received from the custodian until the time that the analyses are completed.

- Once the sample analyses are completed, the unused portion of the sample, together with all identifying labels, is returned to the

custodian. The returned tagged sample is retained in the custody room until permission to destroy the sample is received by the custodian.

- Samples will be destroyed only upon the order of the ABB-ES Project Manager, in consultation with the USAEC COR. This only occurs after elevation of chemical data into the IRDMIS Level 3.

## 5.6 EQUIPMENT CALIBRATION AND PREVENTIVE MAINTENANCE

This section describes calibration protocols for laboratory services and field instruments that may be used at the MAG-1 Area during field activities.

### 5.6.1 Calibration Procedures for Laboratory Equipment

The procedures used for calibration of laboratory equipment are described in Section 5.0 of the Laboratory QA Plan prepared by the laboratory subcontractor as part of the Contract Laboratory Analytical Support Services (CLASS) program. The ESE Laboratory QA Plan is provided as Appendix C of this QAPP. The laboratory will keep records on the source of all standards used, and standards will be traceable to original sources. Check standards from a second source (USEPA or other commercial source) will be used to verify the accuracy of calibration standards. Results must fall within limits specified by supplier or +/-10 percent for inorganics and +/-25 percent for organic analytes.

### 5.6.2 Calibration Procedures and Frequency for Field Instruments

Each piece of field sampling equipment requiring calibration will be calibrated prior to each day's use. As previously discussed in Section 2.0, data are recorded on a form shown as Figure 2-10. The procedures described in the following subsections apply to the specific instrument noted.

Calibration of the field GC is discussed in Appendix A of this QAPP.

### 5.6.3 Yellow Springs Instrument Salinity Conductivity Temperature Meter (Model 33)

The Yellow Springs Instrument Salinity Conductivity Temperature (YSI S-C-T) Meter consists of a temperature probe and a specific conductance meter.

Temperature Probe:

1. Using a National Bureau of Standards-approved thermometer, immerse both probes into a beaker of water and note any differences for the field probe.

2. Recalibrate as necessary.

Specific Conductance Meter:

1. Calibrate meter and probe using the calibration control and the red-line on the meter dial.

2. Turn the function switch to read conductivity x 10 and then depress the cell test button, noting the deflection. If the needle falls more than 2 percent of the reading, clean the probe and retest.

3. Using at least two solutions of different ionic strength which will most likely bracket the expected values for conductivity, note accuracy of the probe and clean probe if necessary.

### 5.6.4 Specific Ion Meter

The Specific Ion Meter consists of a pH probe.

1. Place electrodes and buffer solutions in a water bath at the temperature of the water to be sampled. After temperature equilibrium, measure temperature and adjust the temperature compensation knob for this temperature.

2. If using refillable probes, remove electrode cap and check that filling solution is above the filling mark.

3. Immerse the probe in the pH 7 buffer solution and adjust the calibration control to read the appropriate pH. Check the pH buffer solution for correct pH value at the equilibrated temperature.

4. Remove the probe, rinse with distilled water, and immerse in either the pH 4 or pH 10 buffer solution, depending on the expected pH of the sample.

5. If the meter does not register the correct pH for that buffer solution, adjust the calibration knob on the back of the instrument to obtain the pH of the buffer.

6. After rinsing, insert the pH probe into the flow cell and allow the probe to come to equilibrium with the sample water.

7. Store the pH probe either in ambient air or a buffer solution overnight, according to the manufacturer's specifications.

**5.6.5 Tripar Analyzer**

The Tripar Analyzer consists of a temperature sensor, a specific conductance sensor, and a pH sensor.

Temperature Calibration:

1. Temperature Zero Adjustment. Connect the temperature sensor and select temperature as the display parameter. Remove the rear access cover exposing the sensor calibration potentiometers.

   Prepare an ice water slurry and place the temperature sensor in the solution. Allow the temperature sensor to stabilize for approximately 1 minute while stirring the sensor in the solution vigorously. Using the adjustment tool provided in the rear cover, adjust the temperature "zero" potentiometer for a reading of 0.00°C on the system display.

2. Temperature Span Adjustment. Prepare a test solution to be used for temperature calibration. A beaker of water at room temperature works well as it will not be changing rapidly in temperature. Place the Tripar temperature sensor in the test solution and allow to stabilize for approximately 1 minute. Using a precision laboratory thermometer, measure

the temperature of the test solution. At the Tripar rear panel, adjust the temperature "CAL" potentiometer until the Tripar display reads the value of the calibration solution.

Best results will be obtained if the temperature "ZERO" and "SPAN" calibration procedures are repeated.

Conductivity Calibration:

From time to time, the Tripar conductivity circuit will require calibration. A simple two-point calibration procedure is utilized by first adjusting the conductivity zero and then the span.

1. Conductivity Zero Adjustment. With the conductivity sensor clean, dry, and in air, adjust the conductivity "zero" potentiometer for a reading of 0000 on the Tripar display.

2. Conductivity Span Adjustment. Totally immerse the Tripar conductivity sensor in calibration solution of known conductance. Note that the reading displayed on the Tripar is a temperature corrected value to 25°C. Therefore, the value of the standard solution must be calculated to 25°C. Also, the value of the calibration solution should fall in the upper 50 percent of the ranges to be calibrated (i.e., adjustment of the 1,000 micromho range should be accomplished with a 500 to 1,000 micromho standard). Once the sensor has stabilized in the solution for approximately 1 minute, adjust the conductivity "CAL" potentiometer at the Tripar rear panel for a reading on the display equal to the temperature corrected value of the standard solution.

   Best results will be obtained if the conductivity ZERO and SPAN procedures are repeated.

pH Calibration:

1. pH Standardization. The pH sensor should be standardized before each use after long storage. First, moisten the electrode body with tap water and carefully remove the plastic storage cap covering the tip of the electrode. Care should be taken not to bend the body of the electrode as this can result in damage to the internal element.

For first-time use after long storage, immerse the lower end of the electrode in tap water for 30 minutes. This hydrates the pH bulb and prepares the ceramic wick for contact with test solutions. If air bubbles are present in the pH bulb, shake the electrode downward to fill the bulb with solution.

Prepare a small sample of pH 7 buffer solution and measure the temperature of the buffer. Rinse the pH electrode with distilled water and immerse the pH bulb in the reference buffer. Set the compensation dial in the Tripar front panel to the temperature of the buffer, allow several minutes for the sensor to reach equilibrium, and stir the sensor slightly to dislodge any possible air bubbles from the electrode tip. Using the "Standardize" potentiometer, adjust for a reading of pH 7.00 on the Tripar display.

2. pH Slope Adjustment. Very infrequently, the pH slope adjustment may require recalibration. This adjustment is available at the Tripar readout rear panel. To accomplish this adjustment, prepare a test solution of pH 4 or 10. Measure the temperature of the solution and make the appropriate setting at the pH "Compensation" dial. Rinse the pH electrode in distilled water and immerse in the buffer solution. Allow several minutes for the sensor to equilibrate and stir the electrode slightly. Using the pH "Slope" potentiometer available at the rear panel, adjust the Tripar readout module for a reading equal to the value of the buffer solution. For best results, the pH "Standardize" and "Slope" adjustments should be repeated at least once.

   Note that some interference may be seen on the pH reading if the Tripar conductivity sensor is present in the same test solution as the pH sensor.

### 5.6.6 Photoionization Meters

A number of PID meters are available for field use, as described below.

<u>HNu</u>. With the probe attached to the instrument, turn the function switch to the battery check position. The needle on the meter should read within or above the green battery area on the scale plate. If the needle is in the lower position of the battery arc, the instrument should be recharged prior to any calibration. If the red LED comes "on," the battery should be recharged. Next, turn the function switch to the "on" position. In this position, the ultraviolet (UV) light source should be on.

To zero the instrument, turn the function switch to the standby position and rotate the zero potentiometer until the meter reads zero. Clockwise rotation of the zero potentiometer produces an upscale deflection, while counter-clockwise rotation yields a downscale deflection. If the span adjustment setting is changed after zero is set, the zero should be rechecked and adjusted if necessary. Wait 15 to 20 seconds to ensure that the zero reading is stable. If necessary, readjust the zero. The instrument is now ready for calibration by switching the function switch to the proper measurement range.

Using nontoxic analyzed isobutylene gas available from the manufacturer in pressurized containers, connect the cylinder with the analyzed gas mixture to the end of the probe with a piece of tubing. Open the valve of the pressurized container until a slight flow is indicated and the instrument draws in the volume of sample required for detection. Adjust the span potentiometer so that the instrument is reading the stated value of the calibration gas.

If the instrument span setting is changed, the instrument should be turned back to the standby position and the electronic zero should be readjusted, if necessary. If the instrument does not calibrate, it may be necessary to clean the probe or the lamp connection.

Photovac TIP. The name of this instrument is derived from the fact that it measures total ionizables present (TIP). Turn power switch on by first pulling knob out and then up. Allow the TIP to warm up for 5 minutes prior to use. Turn span knob to max (9) and zero knob to "ZERO." Attach "zero air" cylinder to TIP inlet using PVC tubing. Zero instrument using zero knob only. (TIP is very sensitive so stable reading of absolute zero is difficult and not necessary to achieve.) Next, attach isobutylene cylinder to TIP inlet. Use the span knob to adjust TIP reading to the concentration number on the isobutylene cylinder (usually 60 parts per million [ppm]). Remove cylinder. TIP is now calibrated and ready for use. (Calibration should be checked often because TIP has tendency to drift.) When finished, turn power off by pulling switch out and down. Recharge instrument overnight. (Battery charger must be pushed into place and then screwed into bottom of TIP.)

OVM. An organic vapor meter (OVM) is another variety of PID which will be used during this investigation. The calibration procedure for the Thermo Electron Instruments, Inc. Model 580B OVM is as follows. Refer to the instrument operating manual for additional details.

1. Hit ON/OFF toggle once.

2. Wait until lamp lights (screen will display "PPM = __").

3. Hit MODE toggle.

4. Hit -/CRSR toggle until "RESET" to CALIBRATE comes up.

5. Hit RESET toggle to enter calibration mode. (Screen will display "ZERO GAS RESET WHEN READY".)

6. Hit -/CRSR toggle.

7. Connect zero gas canister via tube and gauge supplied with OVM. Open valve on gauge.

8. Hit RESET toggle. Screen will display "Model 580 Zeroing."

9. When zeroing is complete, screen will display "SPAN/PPM = 0000".

10. Span gas concentration (Isobutylene 100 ppm) is entered by hitting RESET and +/INC toggles simultaneously to increment digit above cursor or RESET and -/CRSR simultaneously to move the cursor.

11. When correct value has been entered, hit +/INC toggle. (Screen will display "SPAN GAS RESET WHEN READY.")

12. Connect span gas canister via tubing and gauge. Open valve on gauge.

13. Hit RESET toggle. Screen will display "Model 580 Calibrating."

14. When calibration is complete, the screen display will return to "RESET" to CALIBRATE. If calibration is acceptable, hit MODE toggle to return screen to run mode.

### 5.6.7 Yellow Springs Instrument Oxidation-Reduction Potential Electrode Assembly (Model 4540)

The oxidation-reduction potential (ORP) device consists of an electrode assembly and cable designed for use with the YSI 3560 Water Quality Monitor System and similar ORP measuring systems.

1. Place the shorting cap on the pH input jack. Rinse the ORP electrode and a temperature sensor with deionized or distilled water and connect them to the meter. Pat dry with a laboratory tissue. Follow with a rinse of a small amount of reconstituted YSI 3682 Zobell solution.

2. Pour 3682 Zobell Solution into a sample cup (such as one from the YSI 3565 Sample Cup Pack) and immerse the ORP electrode and temperature sensor in the solution.

3. Turn on the instrument and allow the sensors to equilibrate in the solution.

4. Set the function switch to the mV mode. Read the temperature and calculate the correction to 25°C by adding 1.3 mV for each degree below 25°C, or by subtracting 1.3 mV for each degree above 25°C; or determine the correction by use of the table provided in the Zobell Solution instrument sheet. A corrected reading within 25 mV of the value indicated assures correct electrode function.

### 5.6.8 Hach Portable Turbidimeter (Model 2100P)

The Turbidimeter consists of a meter and sample cell.

1. Dilute formazin standard solutions from a 4000 National Turbidity Unit (NTU) stock solution equivalent to Hach Cat. No. 2461-11.

2. Use high quality distilled or deionized water (turbidity $<0.5$ NTU) for dilutions, and use the same water for all dilutions.

3. Prepare 20, 100, and 800 NTU formazin standards, as described below, to calibrate the Turbidimeter:

20 NTU

a. Add 100 ml of dilution water to a clean 200-ml class A volumetric flask.

b. With a TenSette pipet add 1.00 ml of well-mixed 4000 NTU Formazin stock solution to the 200-ml flask.

c. Dilute to the mark with dilution water. Stopper and mix.

100 NTU

a. Add 100 ml of dilution water to a clean 200-ml class A volumetric flask.

b. With a TenSette pipet add 5.00 ml of well-mixed 4000 NTU Formazin stock solution to the 200-ml flask.

c. Dilute to the mark with dilution water. Stopper and mix.

800 NTU

a. Add 50 ml of dilution water to a clean 100-ml class A volumetric flask.

b. With a TenSette pipet add 20.00 ml of well-mixed 4000 NTU Formazin stock solution to the 100-ml flask.

c. Dilute to the mark with dilution water. Stopper and mix.

4. Rinse a clean sample cell with dilution water several times. Then fill the cell to the line (about 15 ml) with dilution water.

5. Insert the sample cell in the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment. Close the lid and press I/O.

6. Press **CAL**. The "CAL" and "SO" icons will be displayed (the "0" will flash). The 4-digit display will show the value of the SO standard for the previous calibration. If the blank value was forced to 0.0, the display will be blank. Press → to get a numerical display.

7. Press **READ**. The instrument will count from 60 to 0 (67 to 0 if signal average is on). Read the blank and use it to calculate a correction factor for the 20 NTU standard measurement . If the dilution water is ≥0.5 NTU, E 1 will appear when the calibration is calculated. The display will automatically increment to the next standard. Remove the sample cell from the cell compartment.

8. The display will show the "S1" (with the 1 flashing) and "20 NTU" or the value of the S1 standard for the previous calibration. If the value is incorrect, edit the value by pressing the → key until the number that needs editing flashes. Use the ↑ key to scroll to the correct number. After editing, fill a clean sample cell to the line with **well mixed** 20 NTU standard. Insert the sample cell into the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment. Close the lid.

9. Press: **READ**. The instrument will count from 60 to 0 (67 to 0 if signal average is on), measure the turbidity and store the value. The display will automatically increment to the next standard. Remove the sample cell from the cell compartment.

10. The display will show the "S2" (with the 2 flashing) and "100 NTU" or the value of the S2 standard for the previous calibration. If the value is incorrect, edit the value by pressing the → key until the number that needs editing flashes. Use the ↑ key to scroll to the correct number. After editing, fill a clean sample cell to the line with **well mixed** 100 NTU standard. Insert the sample cell into the cell compartment by aligning the orientation mark on the front of the cell compartment. Close the lid.

11. Press: **READ**. The instrument will count from 60 to 0 (67 to 0 if signal average is on), measure the turbidity and store the value. Then, the display will automatically increment to the next standard. Remove the sample cell from the cell compartment.

12. The display will show the "S3" (with the 3 flashing) and "800 NTU" or the value of the S3 standard for the previous calibration. If the value is incorrect, edit the value by pressing the → key until the number that needs editing

flashes. Use the ↑ key to scroll to the correct number. After editing, fill a clean sample cell to the line with **well mixed** 800 NTU standard. Insert the sample cell into the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment. Close the lid.

13. Press: **READ**. The instrument will count from 60 to 0 (67 to 0 if signal average is on), measure the turbidity and store the value. Then the display will increment back to the SO display. Remove the sample cell from the cell compartment.

14. Press: **CAL** to accept the calibration. The instrument will return to measurement mode automatically.

# 6.0 ANALYTICAL PROCEDURES

Sample preparation and analysis are closely connected and matrix-dependent. Laboratory procedures to be utilized for sample preparation and analysis are referenced in "Test Methods for Evaluating Solid Waste" (USEPA SW-846), Third Edition, September 1986. Depending on analytical requirements and sample matrices, SW-846 procedures for sample preparation, digestion, extraction, and analysis allow flexibility based on the analyst's professional judgement. All methods have been developed and certified by the USAEC Chemistry Branch according to procedures in the USATHAMA QA Program (USATHAMA, 1990). Section 5.4.1 of this QAPP includes a description of QC procedures utilized.

## 6.1 SELECTION OF PARAMETERS

Based on a review of the MAG-1 Area operational history and previous investigations, samples will be analyzed for a list of analytical parameters selected for this investigation. The Project Analyte List for the MAG-1 Area RI/FS is found in Table 6-1.

### 6.1.1 Volatile Organic Analyses

Volatiles will be analyzed in accordance with USAEC Class 1A protocols for gas chromatography/mass spectroscopy (GC/MS) analysis. VOCs that will be analyzed at the MAG-1 Area are those listed in Table 6-1.

### 6.1.2 Semivolatile Organic Analyses

Semivolatiles will be analyzed in accordance with USAEC Class 1A protocols for GC/MS analysis. SVOCs that will be analyzed at the MAG-1 Area are those listed in Table 6-1.

Analysis for pesticide and PCB constituents will be performed in accordance with USAEC CLASS 1A certified protocols for gas chromatography equipped with an electron capture detector (GC/ECD). Compounds that will be analyzed are listed in Table 6-1.

Analysis for explosives will be performed in accordance with USAEC Class 1 certified protocols using the methodology developed by the Cold Regions Research

and Engineering Laboratory (CRREL). Compounds that will be analyzed are listed in Table 6-1.

Soil samples will be extracted for total oil and grease and petroleum hydrocarbons (TPH) using USEPA 9071 and will be analyzed using USEPA 413.2 and 418.1, respectively.

### 6.1.3 Metals

Select metals will be analyzed in accordance with USAEC Class 1 protocols. Groundwater samples will be analyzed for total metals. The metal constituents will be analyzed using one of the following methodologies: inductively coupled argon emission plasma spectroscopy (ICAP), graphite furnace atomic absorption spectroscopy (GFAA), or cold vapor atomic absorption (CVAA). Metals that will be analyzed are listed in Table 6-1.

### 6.1.4 Additional Analyses

Total organic carbon is measured by an instrument which converts the organic carbon in a sample to carbon dioxide (CO2) by wet chemical oxidation. The USEPA SW-846 Method 9060 will be used to analyze for TOC in sediment samples.

### 6.1.5 USAEC Certified and Upper Reporting Limits

The CRL is the minimum concentration which can be reported with a 90% confidence interval that a false positive or false negative is not occurring. The CRL is determined from the confidence intervals of a linear regression of the found concentration and the known concentration. The confidence intervals are created from pooled data from the analysis of the standards over four separate days. The highest concentration of the standards are truncated until linearity is achieved (minimum of three concentration levels must remain). The CRL is analogous to the USEPA Practical Quantitation Limit (PQL). The resulting highest concentration within linear range is the upper reporting limit (URL).

The COD is calculated from the same data set as the method specific CRL. The COD is below the CRL but above the instrument detection limit. The COD is equal to the O.5X the target reporting limit standard analyzed during the performance demonstration sequence. The COD is analogous to the USEPA MDL.

The CRL and URL are laboratory specific and generally depend upon the cumulative error of the standard sequences and the instrumentation that is used. The CRLs and associated URLs for USACE and ESE Laboratory are provided in Tables 6-2 through 6-4 for TCL Volatiles, TCL Semivolatiles, TCL PCBs, target analyte list (TAL) Inorganics. For instances in which compounds are amended to the TCL or are nonperformance demonstrated, the associated PQL is given as referenced in the appropriate USEPA method.

### 6.1.6 USEPA Quantitation Limits and Detection Limits

PQLs is the "lowest level that can be reliably achieved within the specified limits of accuracy and precision during routine laboratory operating conditions" (USEPA SW-846). PQLs are a function of the lowest standard within the standard sequence, the sample aliquot analyzed, and the level of analysis. PQLs are given based on a wet-weight soil aliquot and is dependent on site-specific matrices. The MDL, which is defined as the "minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte is greater than zero" (Federal Register 1984), is typically a factor of 2 to 10 below the PQL. Under SW-846 methodologies PQLs can be estimated from MDLs using set multipliers for various matrices and levels of analysis.

## 6.2 Physical Testing of Soils

The physical analyses for soil samples for the MAG-1 Area include classification using the USCS, Atterberg Limits, and grain size analysis. Physical analyses for sediment samples include grain size analysis. The samples will be placed in 1-liter glass jars. All soil samples for physical testing will be sent to the ABB-ES Geotechnical laboratory for analysis.

Grain size distribution will be determined using ASTM Method D 422. This method uses a sieve to separate particles larger than 75 microns ($\mu$m) from the soil. The distribution of particles smaller than 75 $\mu$m is determined using differing settling rates in a column of water (hydrometer).

Atterberg limits will be determined using ASTM Method D 4318. This method details two procedures for preparing test specimens and a single and multi-point procedure for determining the liquid limit.

Classification of soils will be based on laboratory determination of particle-size characteristics, liquid limit, and plasticity index using ASTM Method D-8247. The system is based on the USCS.

### 6.2.1 Reference Materials

Reference standards are required to generate certification data, calibrate instruments, spike analytical surrogates or standards, and prepare QC samples. These solutions must be of known concentration and purity to achieve the criteria necessary for validation of analytical analyses.

Standards used to conduct analytical analyses will be either Standard Analytical Reference Materials (SARMs) or Interim Reference Materials (IRMs). SARMs that are developed and distributed by the Central QA Laboratory from the National Institute of Standards and Technical (NIST) Standard Reference Materials (SRMs) or traceable to National Bureau of Standards (NBS) SRMS will be the preferred standard. IRMs are not as rigorously characterized as SARMs.

Reference materials for metal analyses may be stored at room temperature in a locked storage area. Materials for organic analyses must be stored in a locked refrigerator at or below 4°C.

## 6.3 Data Validation, Reduction, and Reporting

### 6.3.1 Collection

Data are initially collected, converted to standard reporting units, and recorded in standard formats by the project analysts. These project analysts conduct preliminary data analyses using a variety of methods and procedures. Because many analytical instruments are microprocessor controlled, some of the requisite analyses can be performed directly in the instrument's operating or outputting mode. Those instruments interfaced to stand-alone computers or microprocessors often permit data analysis programs to be written and modified to produce data formats specifically suited to end user requirements.

Data requiring manual recording, integration, and/or analysis may be converted to a more appropriate format prior to subsequent analyses. Through all stages and aspects of data processing, the data are double checked for translation or

transcription errors and are initialed by both the recorder and the checker. The QA Manager or other designated individual not directly involved in the analysis reviews the data for acceptability.

### 6.3.2 Reduction

Data reduction frequently includes computation of analytical results from raw instrument data and summary statistics, including standard errors, confidence intervals, test of hypothesis relative to the parameters, and model validation.

Data reduction procedures that the laboratory will utilize address the reliability of computations and the overall accuracy of the data reduction. The numerical transformation algorithms used for data reduction will be verified against a known problem set to ensure that the reduction methods are correct.

The equations and the typical calculation sequence that should be followed to reduce the data to the acceptable format is instrument- and method-specific. Where standard methods are modified, data reduction techniques will be described in a report accompanying the data.

Auxiliary data produced for internal records and not reported as part of the analytical data include the following: laboratory worksheets, laboratory notebooks, sample tracking system forms, instrument logs, standard records, maintenance records, calibration records, and associated quality control. These sources will document data reduction and will be available for inspection during audits and to determine the validity of data.

Outliers will be identified by the USAEC control chart program, and the rationale used for data acceptance or rejection will be described and documented.

### 6.3.3 Performance Demonstration and Data Review

Samples will be analyzed by ESE Laboratory, Gainesville, Florida in accordance with USAEC performance demonstrated analytical methods and additional analytical methods which include USEPA methodology. ESE laboratory is certified for the USAEC analysis of the baseline analytes of concern at the MAG-1 Area. The laboratory provides weekly quality control submittals to USAEC in the form of QC charts. USAEC is responsible for reviewing the analytical data analyzed by USAEC methodology and evaluating the compliance of the data to the USATHAMA QA

Program (USATHAMA, 1990). USAEC audits the laboratory on a semi-annual basis, but may choose to conduct an unannounced audit at any time. ABB-ES chemists are responsible for reviewing and determining potential limitations within available guidelines for analytical data analyzed by non-USAEC methodologies.

Non-USAEC methods will be used for the TOC. Data review and determination of limitations for non-USAEC methodology will be completed and will encompass three fundamental elements:

- The analytical data will be evaluated against the method specific requirements to ensure that the method requirements have been met;
- Limitations of the database will be determined through relevant guidance documents or elements relevant to validation guidelines as given by USEPA CLP program; and
- Technical quality of the data will be assessed and any potential limitations to the database will be fully documented and cross referenced to the associated raw data.

In assessing the method specific requirements, the following data elements should be reviewed:

- Sample Collection Data: associated field screening results, sample collection field logs, COC forms, and shipping forms;
- Sample Analytical Data: non-conformance summary, sample preparation data, raw data from sample data acquisition, and instrument operating parameters;
- Associated Calibration Data: instrument tuning data, initial calibration data, continuing calibration data, instrument specific detection limits, instrument operating parameters;
- QC requirements: surrogate recoveries, instrument and method blanks, field blanks, matrix spike recoveries and precision, laboratory and field duplicate precision, and laboratory control standard recoveries; and
- QA requirements: performance evaluation samples.

TOC data review will use the guidance of referenced methodology QA/QC requirements and/or laboratory QA/QC protocols. In addition, data validation procedures for non-metal inorganic parameters as given in Quality Assurance (Quality Control Guidance for Removal Activities: Sampling QA/QC Plan and Data Validation Procedures (USEPA/540/G-90/004) will be used. The following items will be reviewed by ABB-ES to determine limitations for the TOC data:

- Sample Collection Data;
- Sample Holding Times and Methods of Preservation;
- Detection Limits Compliance;
- Documentation that the analytical results are in control and within the linear range of the analysis;
- Associated calibration data to confirm that the linear regression is > 0.995;
- Documentation on the traceability of calibration and control standards;
- Associated control checks to confirm that the daily analysis is in control;
- Documentation of analytical methodology and QC methodology;
- The potential presence of contamination from field sampling activities (check field duplicates and field blanks); and
- The potential presence of interferences and accuracy in analytical methods (check laboratory blanks and spike recoveries).

### 6.3.4 Reporting

Chemical data shall be reported in the USAEC IRDMIS. The analyst shall quantify each analyte in the method blank and spiked QC sample each day of analysis. Method blank data shall generally be reported as "less than" the CRL for each analyte. Values detected above CRL shall be reported as determined, with entry into the USAEC data management system in terms of concentration. Processing of

additional sample lots will not occur until the results of the previous lots have been calculated, plotted on control charts as required, and the entire analytical method shown to be in control. A detailed description of the IRDMIS is provided in Section 7.0 of this QAPP.

# 7.0 DATA MANAGEMENT

Proper data management during this investigation will enable and facilitate reliable and defensible conclusions. Experience in conducting environmental surveys and assessments has shown that organization plays a key role in ensuring that the large quantities of data collected in support of a particular project are put into a form that is easy to review and understand.

## 7.1 ORGANIZATION

The Task Manager, Mr. Glenn Daukas is responsible for all activities, including data management. In addition to handling administration, coordination, and operations associated with the project, the Task Manager will periodically monitor the flow of data to ensure that schedule, technical quality, and resource requirements are met. The Task Manager will also be responsible for briefing technical personnel on the requirements of the project, and for identifying and resolving any technical problems concerning data management.

The Program Data Coordinator (PDC), Ms. Elizabeth Dawes, will handle the day-to-day monitoring of data management activities by ensuring that the collected data are properly coded and entered into the IRDMIS. The PDC will also have the authority to enforce proper procedures, and to implement actions to ensure the accurate and timely flow of data.

The Quality Assurance Manager, Mr. Chris Ricardi will be responsible for reviewing all data records that have been coded and checked by the PDC to ensure that they are accurate, complete, and supported by adequate documentation.

The Field Sampling Team, which will be directed by the Site Operations Leader Mr. Rod Pendleton, will be responsible for collecting and documenting the data on field parameter forms in the appropriate field logbooks (see the QAPP also included with this submittal). The Site Operations Leader will ensure that the completed forms are checked for accuracy and presented to the PDC in a timely manner.

## 7.2 INSTALLATION RESTORATION DATA MANAGEMENT INFORMATION SYSTEM

### 7.2.1 System Description

The IRDMIS is an integrated system for the collection, validation, storage, retrieval, and presentation of Installation Restoration and Base Closures data. The IRDMIS PC Tool, is a major component of IRDMIS, which provides the ability to enter chemical, geotechnical, and map data in support of the USAEC Installation Restoration and Base Closure Programs. Each contractor is supplied with the appropriate microcomputer-based software to allow for record entry, error checking, and quality control for chemical, geotechnical and map data into IRDMIS. Records accepted by the local error checking program are then transmitted through a Bulletin Board system (BBS), AT&T Model 3B2 minicomputer, which is centrally located at the USAEC Edgewood, MD facility. Subsequent processing (duplicate error check) at Potomac Research Incorporated (PRI) results in an elevation of the accepted records to a higher file "level" and the eventual updating of installation-specific data bases on a Pyramid System. It is understood that the Army is in the process of changing supporting hardware; however, it is expected that the procedures for data entry, validation, and archival will remain the same.

### 7.2.2 Data Management

There are three levels of data recognized in the IRDMIS. Level 1 consists of all files on the ABB-ES microcomputer that have been entered or generated by the error checking program. Once data have been entered in the IRDMIS it will be checked by both the PDC and the QA Manager. These data are then archived into a transfer file and transmitted via modem to PRI.

It is anticipated that error-free files will be transmitted on a weekly basis to the PRI local area network. The ABB-ES terminal will be linked to the network using software supplied by USAEC and a Hayes modem. Terminal usage logs will be established and maintained as a permanent record of communications. If communications cannot be established and maintained, ABB-ES will seek optional means, where needed, for forwarding the data to USAEC. Once the transfer file has been transmitted, the PDC will contact PRI by telephone to notify them of the transmittal. Each Monday, PRI will send a telefax to ABB-ES listing the files received and the acceptance status. To verify acceptance, PRI will process each file through an error checking program that is identical to the one on ABB-ES's microcomputer. Accepted files will then be sent to the UNISYS mainframe. Should

any files fail this final error check, ABB-ES will be notified and required to correct detected errors and retransmit the data.

Upon arrival at the UNISYS, the files will be classified as Level 2 files. Level 2 files will exist only until the data are loaded into the USAEC database, normally within 10 working days.

Data in the USAEC database are considered Level 3 data. They may be accessed by ABB-ES using USAEC-supplied report programs and the appropriate read key; however, they are protected from changes by a write key.

Data management begins when USAEC transmits a request for analytical services to the laboratory, stating the number, type, sample numbers, methods for analysis, and any other information necessary for the laboratory to plan a particular job.

While in the process of collecting, documenting, packaging, and shipping samples to the laboratory, the field sampling team will record field parameter information in the appropriate logbook. Once the samples arrive at the laboratory, the site type/site ID information will be combined with analytical results, by analytical lot, and the information entered into Level 1 data files in the IRDMIS. The laboratory will validate the data, perform error-checking and correction using the USAEC routines, and transmit the Level 1 files to USAEC, via the 3COM communications network. Hard-copy documentation will also be transferred from the laboratory to USAEC. The field sampling team will transmit location information from the field logbook to the PDC, who will input the data into map files for the site. The map files will be checked against the original field logbook entries.

Once the Level 1 files have been processed at USAEC, the PDC will transmit any required corrections, then generate a backup disk copy. This step will be completed within 50 days after the samples have been collected. The laboratory will archive copies of all analytical data, including original instrument magnetic tapes, until approval for release is obtained from USAEC. Records will also be maintained, so that historical summaries of all analyses may be generated. Figure 7-1 presents a summary diagram of how these data will be handled.

## 7.3 Project Data

Data for entry into the IRDMIS and generated during this project will consist of geotechnical data and sampling/analytical data. The types, origin, IRDMIS files, and handling of these data are described below.

### 7.3.1 Geotechnical Data

A Geotechnical Map File (GMA), an IRDMIS geotechnical data file type, will be generated by the Field Team activities during the investigation conducted at Ft. Dix. The GMA contains locational information about groundwater monitoring wells, and soil samples. These files are generated from field logbooks, boring logs, and field parameter forms used by the Site Geologists and must precede all other data files for a particular site type and site ID.

The map file is a listing of sample sites and corresponding location coordinates. Map files will be created from the sample site data, and input into the IRDMIS. Elevation and locational coordinates are obtained by surveying (wells) or from maps (other sampling points), and are submitted by the SOL to the PDC, who creates the map file. These data are entered into the computer by the PDC, and a computer printout of the file is checked and corrected by the SOL.

One other type of geotechnical data file will be created for the MAG-1 site: Geotechnical Groundwater Stabilized (GGS) Files, containing records of groundwater level measurements during sampling.

Data that are not entered into the IRDMIS will be logged into notebooks, then packaged with any hard-copy outputs (e.g., plots, charts), and sent to the PDC. Both the PDC and the QA Manager will review these data, referred to as field data, before the PDC archives the information for future reference.

### 7.3.2 Sampling and Analytical Data

Data management of field screening data (select VOCs) from the field GC is discussed in Appendix A of this QAPP. Field screening data from immunoassay tests (RDX) will be kept in a separately bound logbook. In addition, during the field screening program, all VOCs and RDX data will be uploaded to electronic format for use in plotting to assess horizontal and vertical distribution of contaminants.

Data from analyses performed by the analytical laboratory are input into various chemical data files. The laboratory is also responsible for validation of the data for generation of error-free files. Data from sampling activities that are required by the laboratory will be submitted by the sampling team on field parameter forms, along with the samples. The sampling organization will also be responsible for generation of all map files, as described above. A description of sampling and analytical data generation and manipulation is provided below.

Sampling data will be collected in the field in a permanently bound logbook. Information will be recorded on two-part field parameter forms. Each logbook will be specific to the matrix being sampled. This information will include the site type, site ID, sampling date and time, field sample number, sample depth (if applicable), and the sampling technique. One copy of this form will accompany each sample to the laboratory so that the information can be encoded prior to sample analysis. In addition, each sample container will be annotated in waterproof ink with the installation name, sample number, sampling date, analytes, and preservatives. A COC form will also be completed in the field and will accompany the samples to the laboratory, along with the field parameter form. One copy of the field parameter form is bound in the logbook, for use in creating map files.

Collection of analytical data will begin when samples arrive at the laboratory. A laboratory technician will first verify that the samples noted on the COC form coincide with the sample containers being delivered. If any containers are broken or missing, the COC form will be annotated and the SOL will be notified immediately. Samples will then be logged into a project-specific notebook and the computerized laboratory data management system according to parameter code, site ID, and laboratory sample number. The field parameter and COC forms will then be submitted to a laboratory data technician for later correlation with the analytical results.

On receipt of the sample log information, the laboratory QAC will assign analytical lot numbers to the samples in accordance with USAEC procedures. The first three letters of the six-character sample code will designate the analytical lot, while the remaining three digits will indicate the sample number within the lot (e.g., AAB006 indicates the sixth sample in lot AAB). All quality control samples required for each analytical lot (e.g., method blank, control spike at two times the CRL, and two control spikes at ten times the CRL) will also receive USAEC sample numbers. The data technician will enter the sample information into the IRDMIS to generate partially-completed data coding forms.

When the samples are taken from storage for analysis, the COC form will be signed by the Data Analyst to acknowledge receipt of the samples for processing. When analyses are complete, the Data Analyst will evaluate the data for QC samples to determine if the analyses were in control. The QC results will then be reviewed by the Laboratory Section Manager and forwarded to the QAC for verification. If the QAC agrees that the data are in control, the Data Analyst will be directed to proceed with data reduction for the samples. Concentrations of contaminants in extracts will be determined from instrumental responses of the extracts applied to the instrument calibration curve. The resultant concentration will then be modified by applying the appropriate dilution/concentration and sample weight or volume to obtain a final reportable concentration in the original matrix. Soil sample results will not be corrected for moisture, but percent moisture will be reported with the result. Aqueous samples will be reported in terms of micrograms per liter and solid samples will be reported in micrograms per gram.

The data will contain no more than three significant digits and will be rounded to the appropriate number of significant digits, based on certification class and dilution, only after all calculations have been completed. When samples are diluted into a certified range, the reported concentration will contain one less significant digit than an undiluted sample. Values less than the CRL will be reported as "less than" the CRL. If a sample is diluted below the CRL, the value will be reported as "less than" the CRL multiplied by the dilution factor to more accurately reflect the observable limit. The dilution factor will be reported with the data. Method blank values will not normally be subtracted from sample results submitted to IRDMIS; however, method blank corrections may be made in accordance with the USAEC QA Program (3rd ed., Subsection 11.3.1). It should be noted that data deletions as a result of qualifications from blank contamination will occur only during the risk assessment phase.

When data reduction has been completed for the samples, all data will be transmitted to USAEC. The correlation of the analytical and field data will be performed by PRI. Table 7-1 lists the information that is required for the IRDMIS.

### 7.4 Sample Management System

ABB-ES will employ its computerized Sample Management System to track environmental samples from field collection to shipment to the analytical laboratory. ABB-ES will also track the status of analyses and reporting by the analytical laboratory.

Each day the field sampling team(s) will carry computer-generated sample labels into the field that state the sample control number, sample identification, size and type of container, sample preservation summary, analysis method code, and sample medium. The labels will provide space for sampling date and time and the collector's initials to be added at the time of collection.

Samples will temporarily stored in the ABB-ES field office refrigerator. They will be checked-in on the computer, and the collector's initials and the sampling date and time entered. The system will then indicate the sample status as "COLLECTION IN PROGRESS."

When the samples are prepared for shipment, they are "RELEASED" by the sample management system. Upon request, the system prints an ARF and a COC, which are signed and included with the samples in the shipment. The system will then indicate the sample status as "SENT TO LAB."

This system substantially reduces the time required for preparation of sample tracking documentation, and it provides an automated record of sample status.

After shipment of samples to the laboratory, ABB-ES continues to track and record the status of the samples, including the date of analysis (to determine actual holding times), the date a transfer file is established by ESE, and the date the data is sent to IRDMIS.

# 8.0 SYSTEM CONTROLS

This section discusses document control, QC samples, control charts, and out-of-control conditions. System controls for field GC procedures are presented in Appendix A of this QAPP.

## 8.1 QUALITY CONTROL SAMPLES

QC samples are analyzed to provide quantitative evidence supporting the performance of the analytical system, and demonstrate that the sensitivity is analogous to the level achieved during certification.

QC samples will be identified by the analyst conducting the actual analysis. Sample numbers will be assigned during the logging-in process for inclusion in the sample train as a check on analytical method performance.

The QC sample is prepared by the person conducting the first step of the analytical method. Solution concentration, standard matrix, spiking levels, and frequency of control samples will be specified in the certified method, as delineated in the USATHAMA QA Program (USATHAMA, 1990). Table 8-1 provides quality control criteria that laboratories must follow for organic and inorganic constituents.

## 8.2 CONTROL CHARTS

Where applicable, control charts will be used to monitor the trends and variations in the accuracy and precision of analytical analyses. The control chart shall contain the following:

a. Title, analyte, method number, and laboratory name;
b. Spike concentration;
c. Three-letter lot designation and analysis date for each point along the abscissa;
d. Percent recovery (X charts) or Range (R charts) along the ordinate;
e. Upper and lower control limits; and
f. Upper and lower warning limits.

Criteria and formats for control chart construction can be found in the USATHAMA QA Program (USATHAMA, 1990).

### 8.3 OUT-OF-CONTROL CONDITIONS

Situations arising from failure to adhere to standard operating procedures, policies, and protocols mandated by the USATHAMA QA Program (USATHAMA, 1990) have the potential to adversely affect data quality and affect investigation and or corrective action. All out of control situations for all project aspects will be investigated and appropriate corrective actions instituted. Areas in which operator error is normally associated with out-of-control conditions include:

a. Failure to achieve calibration;
b. Recordkeeping omissions;
c. Improper sampling techniques;
d. Improper sample storage and preservation; and
e. Poor analytical protocols.

The detection of out-of-control conditions warrants some type of corrective action. The ABB-ES QA Manager will be responsible for investigation out-of-control situations. Section 12.0 of this plan provides protocols for documenting corrective action.

# 9.0 PREVENTIVE MAINTENANCE

## 9.1 ANALYTICAL INSTRUMENTATION

Preventive maintenance of analytical instrumentation is addressed by the Laboratory QA Plan. A copy of the ESE plan is provided for reference in Appendix C.

## 9.2 FIELD INSTRUMENTS

Preventive maintenance of field equipment, which is performed by analysts, field personnel, and sample program staging area staff, routinely precedes each sampling event; more extensive maintenance is performed by manufacturers on the basis of hours in use. Sampling crews report on the performance of the equipment after each sampling event. Critical spare parts are kept in stock. At times, it is necessary to perform routine maintenance in the field; therefore, each field instrument is provided with an operating manual.

Maintenance and operation of the field GC is discussed in Appendix A of this QAPP.

# 10.0 RECORDKEEPING

Bound logbooks shall be utilized for all recordkeeping purposes both in the field and laboratory. It is assumed that the use of the bound book will result in a chronological sequence of data insertion. All logbooks will contain a unique document control number. If corporate controlled logbooks are used, the document control number will be on all pages. Non corporate controlled logbooks will be bound, and the document control number need only be contained on the document cover. All pages will be numbered, but numbered pages may be limited to pages with information.

To facilitate data validation, the person making an entry must sign and date the entry. All entries must be recorded in ink. Correction to entries shall be made by drawing a line through the incorrect entry, recording the correct information, and initialling and dating the corrected entry.

If computerized information is utilized, a hard copy which has been permanently affixed to the logbook will be acceptable as an original record of sampling and laboratory logging.

Logbooks containing information specific to the project shall be forwarded to USAEC at the end of the project. Should the need for corporate controlled logbooks arise, copies of all relevant logbook pages shall be submitted.

## 10.1 SAMPLING

Logbooks must be bound, and entries recorded in waterproof ink. The logbook must contain information to distinguish samples from each other. The following information should be included for each sample collected:

a. USAEC project;
b. Sequential field sample number;
c. Matrix sampled;
d. Sample depth;
e. Sampling date and time;
f. Specific sampling location;
g. Method of sampling;

h. Preservation techniques;
i. Filtration method;
j. Analytes of interest;
k. Volume of water removed during well development;
l. Sampling observations;
m. Results of field measurements;
n. Printed name and signature of samplers;
o. Date of shipment;
p. Number of shipping containers; and
q. Samples sent and carrier.

## 10.2 LABORATORY RECORDS

### 10.2.1 Field Analytical Records

Record keeping procedures for field GC activities are presented in Appendix A of this QAPP.

### 10.2.2 Analytical Laboratory Records

**10.2.2.1 Laboratory Logging.** Once samples have been received by the laboratory, they shall be logged into a bound laboratory notebook. Information necessary for the logbook includes:

a. Field sample number;
b. Laboratory receipt date;
c. Condition in which sample arrived;
d. Analysis requested; and
e. USAEC sample identification number.

**10.2.2.2 USAEC Sample Identification Numbers.** Data reporting to the USAEC IRDMIS requires that each aliquot of a sample be assigned a six-character sample identification number. The number is comprised of two three-letter character designations. The first three characters define the analytical lot, which is based upon the number of samples capable of being processed in a 24-hour period. The last three characters pertain to the sequential order in which the instrumental analysis will be performed within the lot.

Different lot designations are used for each analytical method. Multi-analyte methods have the same lot designation for each analyte in a single sample aliquot. Should the contractor laboratory utilize an internal numbering system, the correlation to the USAEC sample identification number shall be provided in the logbook.

**10.2.2.3 Analytical Records**. Reference Materials. Bound logbooks must be maintained of all reference materials used for analytical purposes on the project. The record must include the following information:

a. Date of receipt;
b. Source;
c. Purity;
d. Composition;
e. Storage conditions; and
f. Expiration date.

Sample Handling. All personnel involved in performing any aspect of the analytical protocol must maintain a record of the activities in a bound logbook. Although this logbook must be specific to the operation, it need not be operator specific. The logbook should be signed and dated daily and contain the following information:

a. Samples handled;
b. Standards used;
c. QC samples prepared;
d. Procedures used; and
e. Resultant calculations.

Instrument Operation. Each instrument must have a dedicated logbook. Information in the logbook must reflect routine and emergency maintenance activities, tuning, absolute and chemical curve calibration, and all analytical activities conducted on the instrument. A new page must be started daily during equipment operation. Information to be included for each page consists of:

a. Date, operator, and project name;
b. Description of any instrument maintenance or modification;
c. Tuning and calibration activities;
d. Instrument settings;
e. Instrument operating conditions; and
f. Samples analyzed.

The use of automated data acquisition systems will require recording a reference to the data file for each standard or sample.

Hard copy data output from integrators and chromatograms should have the following information clearly evident on the printout:

a. Analysis date and time;
b. Test name and sample number;
c. Reference to the calibration curve used for quantitation;
d. Logbook reference to recorded analytical activities; and
e. Identification of chromatographic peaks.

# 11.0 AUDITS

Audits are performed to ensure and document that QC measures are being utilized to provide data of acceptable quality, and that subsequent calculations, interpretation, and other project outputs are checked and validated. Both scheduled and unscheduled audits are provided for in the QA program.

System and performance audits may be conducted by the ABB-ES QA Supervisor. The QA Supervisor may also conduct project audits of calculations, interpretations, and reports which are based on the measurement system outputs. The QA Supervisor will conduct audits of field work and reviews of the project assessment elements. The Laboratory QAC will perform systems, methods, and performance audits in accordance with the Laboratory QA Plan. These will be submitted for review and approval to the ABB-ES QA Supervisor. The ABB-ES QA Supervisor may also conduct laboratory audits.

In addition to routine audits, ABB-ES will implement project and deliverable review systems to assess scope compliance and overall technical quality of the contracted services.

## 11.1 SYSTEMS AUDIT

A systems audit may be conducted on all components of measurement systems to determine proper selection and utilization. The systems audit includes evaluation of both field and laboratory procedures.

The project or field team organization is reviewed for compliance with the proposed organization and for clarity of assigned responsibility. Personnel assigned to the project will be reviewed to ensure that assigned responsibility, skill, and training are properly matched. The ABB-ES Project Manager maintains firsthand knowledge of his team's capabilities and will discuss the organization's efficacy with the QA Supervisor. Assigned personnel may be interviewed by the QA Supervisor during an audit.

The audit will address whether field equipment and analytical instruments are selected and used to meet requirements specified by the project objectives stated in the QAPP. Equipment and facilities provided for personnel health and safety may

also be evaluated. Calibration and documentation procedures for instruments used in the field also receive attention.

A review of analytical methodology in regard to the data requirements for the project will be performed. An on-site observation of analyst technique, data reduction, and record keeping may be performed if determined necessary. Periodic review of precision and accuracy of data will be conducted.

An audit of scheduled samples versus samples collected versus samples received for analysis may be performed. Field documentation may be reviewed. If deemed necessary, a site visit to Ft. Dix will be made to ensure that designated control procedures are practiced during sampling activities.

During a system audit, the QA Supervisor will review data handling procedures with the Project Manager. Accuracy, consistency, documentation, and appropriate selection of methodologies will be discussed.

For each field or systems audit, a checklist will be prepared as shown in the USATHAMA QA Program, and submitted to the ABB-ES Program Manager.

## 11.2 Performance Audit

USEPA Region II may choose to submit a spiked performance evaluation (PE) sample to the SOL. This sample will be submitted to the laboratory with the other environmental samples collected at Ft. Dix. The sample will be analyzed for those analytes requested by USEPA. The results of the analysis will be used by USEPA to determine laboratory accuracy.

## 11.3 Project Reviews

Project reviews are scheduled and conducted by the Program Manager. The intent of a project review is to assess scope compliance and overall technical quality of the contracted services. A project review is appropriate at instances such as (1) sampling design plan finalization; (2) end of field program; and (3) determination of conclusion and recommendations. Documentation of the project review, especially identified action items and their follow-up, is essential to maximizing the utility of these reviews. Figure 11-1 provides an example Project Review Record.

## 11.4 Quality Assurance Audit Report

QA audits are conducted at the request of management or clients and occur less frequently than project reviews. A written report of a QA project audit will include the following:

- an assessment of project team status in each major project area;
- clear statements of areas requiring improvement or problems to be corrected;
- recommendations and assistance regarding proposed corrective actions or system improvements (if no action is required, the report will state that the QA audit was satisfactorily completed); and
- a timetable for any corrective action required.

Figure 11-2 provides an example QA Audit Report. Distribution of the report will include the Project Review Committee, Project Manager, Program Manager, and USAEC COR. This form will cover any field or laboratory audit checklist (internal) or external audit performed by USAEC or regulatory agency personnel. The ABB-ES QA Supervisor is responsible for the coordination of such audits, the disposition of the audit records, and the monitoring of corrective actions.

## 11.5 Quality Review of Studies and Report Preparation

The purpose of quality review through the course of studies, designs, and reports is to ensure that the service, designs, and documents meet currently accepted professional standards and project requirements. QA reviews will be scheduled on a routine basis for the Ft. Dix project. The Project Review Committee will be an integral part of this process.

QA during the preparation of studies and reports relies on documentation of data utilized and peer review of conclusions drawn from the assembled data base. This allows all data base components to be traced to the primary generator and forces a review of data quality as the data base is developed. Project personnel are responsible for utilization and monitoring of this process; compliance is audited by

the QA Supervisor. Upon completion of the data base, data interpretation, evaluation, and report preparation commence. Interpretation may require consultation with ABB-ES' statistician and/or use of computerized statistical routines. Documentation is also prepared for statistical manipulation methodologies. Data evaluation incorporates peer review to provide broad-based insight to data correlations and interactions.

To enhance the professional quality of the company's studies and reports, the Project Manager will also (1) require that reports refer to and are consistent in scope with the project proposal and contract; and (2) require that report language and contents be chosen to foster client understanding of risks and uncertainties by distinguishing fact from opinion and identifying risks and limitations in a clear and informative manner.

Implementation of QA for reports involves the use of a review routing and sign-off form. Figure 11-3 illustrates the ABB-ES Deliverable Review Tracking Form. The Program Manager provides final review and release for all deliverables.

# 12.0 CORRECTIVE ACTION

Corrective or preventive action is required when potential or existing conditions are identified that may adversely impact data quantity or quality. Corrective action could be immediate or long term. In general, members of the program staff who identify a condition adversely affecting quality can initiate corrective action by notifying his/her supervisor and the QA Supervisor in writing. The written communication will identify the condition and explain how it may affect data quality or quantity.

## 12.1 IMMEDIATE CORRECTIVE ACTION

Immediate corrective action is usually applied to spontaneous, nonrecurring problems (e.g., instrument malfunction). The individual who detects or suspects nonconformance to previously established criteria or protocol in equipment, instruments, data, or methods, will immediately notify his/her supervisor. The supervisor and the appropriate Task Leader will then investigate the extent of the problem and take the necessary corrective steps. If a large quantity of data is affected, the Task Leader must prepare a memorandum to the Project Manager and QA Supervisor. These individuals will collectively decide how to proceed. Corrective measures will be coordinated with USAEC and any actions taken by the laboratory will be reported in weekly QC submittals. If the problem is limited in scope, the Task Leader will decide on the corrective action measure and document the solution in memorandum form.

## 12.2 LONG-TERM CORRECTIVE ACTION

Long-term corrective action procedures are devised and implemented to prevent the recurrence of a potentially serious problem. The QA Supervisor will be notified of the problem and will conduct an investigation to determine the severity and extent of the problem. The QA Supervisor will then file a corrective action request with the Project Manager, Task Leader, and Program Manager. In case of dispute, the Corporate Officer will make a final determination for the company. If the corrective action will impact project budget or schedule, the action requires involvement of the USAEC COR.

Corrective actions may also be initiated as a result of other activities, including (1) performance audits; (2) system audits; (3) laboratory/field comparison studies; and (4) ongoing project audits.

The QA Supervisor will be responsible for documenting all notifications, recommendations, and final decisions. The Project Manager and the QA Supervisor will be jointly responsible for notifying program staff and implementing the agreed-upon course of action. The QA Supervisor will be responsible for verifying the efficacy of the implemented actions. The development and implementation of preventive and corrective actions will be timed, to the extent possible, so as to not adversely impact either project schedules or subsequent data generation/processing activities. The QA Supervisor will also be responsible for developing and implementing routine program controls to minimize the need for corrective action.

Examples of long-term type of actions include:

- staff training in technical skills or in implementing the QA Program;
- rescheduling of laboratory routine to ensure analysis within allowed holding times;
- identifying vendors to supply reagents of sufficient purity; and
- revision of Contractor QA system or replacement of personnel.

For either immediate or long-term corrective actions, steps comprising a closed-loop corrective action system are as follows:

- define the problem;
- assign responsibility for investigating the problem;
- investigate and determine the cause of the problem;
- determine a corrective action to eliminate the problem;
- assign and accept responsibility for implementing the corrective action;

- establish effectiveness of the corrective action and implement the correction; and
- verify that the corrective action has eliminated the problem.

Depending on the nature of the problem, the corrective action employed may be formal or informal. In either case, occurrence of the problem, corrective action employed, and verification that the problem has been eliminated will be documented.

# 13.0 QUALITY CONTROL REPORTS

## 13.1 QUALITY ASSURANCE AND QUALITY CONTROL REPORTS

As noted in previous sections, reports of a variety of QA and QC activities are provided to managers at appropriate levels of the project organization. All QA and QC reports are available to USAEC. These reports include the following:

| QC REPORT TYPE | GENERATED BY | DISTRIBUTED TO | FREQUENCY |
|---|---|---|---|
| Field Instrument Calibration | Field Crew | Field Leader, PM | Daily during sampling event |
| Sample Field Data Records | Field Crew | Field Leader, PM | Per sample |
| Analytical Quality Control Documentation | Laboratory | USAEC, PM, QAS | Weekly |
| Project Review Record | Prog. Mgr., Project Review Committee | DQA, Team Leaders, QAS, Prog.Mgr. | As needed |
| Deliverable Review Record | PM/Author | Team Leader, QAS, Prog.Mgr. | Per deliverable |
| Project Audit Report | QAS | DQA, Line Mgr., Prog.Mgr. | As needed |
| Corrective Action | Any Team Member | USAEC, Prog. Mgr., QAS, Team Leader, PM, Project Review Committee | As needed |

**Notes:**

PM = Project Manager
DQA = Director of Quality Assurance
QAS = Quality Assurance Supervisor

## 13.2 PROJECT DELIVERABLES

The reports scheduled for submission to USAEC during the RI/FS activities are listed in Table 13-1. The table also lists the distribution requirements.

| | |
|---|---|
| QC | Quality Control |
| RAS | Routine Analytical Services |
| RDX | cyclonite |
| RI/FS | remedial investigation/feasibility study |
| RPD | relative percent difference |
| SARMs | Standard Analytical Reference Materials |
| SAS | Special Analytical Services |
| SOL | Site Operations Leader |
| SOP | standard operating procedure |
| SRMs | Standard Reference Materials |
| TAL | target analyte list |
| TBC | to be considered |
| TCL | target compound list |
| TIP | total ionizables present |
| TOC | total organic carbon |
| TPH | total petroleum hydrocarbons |
| TRADOC | U.S. Army Training and Doctrine Command |
| TCE | trichloroethene |
| URL | upper reporting limit |
| USAEC | United States Army Environmental Center |
| USATHAMA | United States Army Toxic and Hazardous Materials Agency |
| USCS | Unified Soil Classification System |
| USEPA QAM | United States Environmental Protection Agency Quality Assurance Manual |
| USEPA | United States Environmental Protection Agency |
| UV | ultraviolet |
| VOC | volatile organic compound |
| 12DCE | 1,2-dichloroethene |

| | |
|---|---|
| ABB-ES | ABB Environmental Services, Inc. |
| AMCCOM | U.S. Army Armament, Munitions, and Chemical Command |
| ARARs | Applicable or Relevant and Appropriate Requirements |
| ARF | analytical request form |
| ASTM | American Standards and Test Methods |
| BBS | Bulletin Board System |
| C2H3CL | vinyl chloride |
| CCC | Civilian Conservation Corps |
| CCL4 | carbon tetrachloride |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CLASS | Contract Laboratory Analytical Support Services |
| CLP | Contract Laboratory Program |
| CO2 | carbon dioxide |
| COC | chain of custody |
| COD | criteria of detection |
| COR | Contracting Officer's Representative |
| cps | counts per second |
| CRDL | contract required detection limits |
| CRL | Certified Reporting Limits |
| CRQL | contract required quantitation limits |
| CRREL | Cold Regions Research and Engineering Laboratory |
| CVAA | cold vapor atomic absorption |
| DOD | Department of Defense |
| DOT | Department of Transportation |
| DQO | Data Quality Objectives |
| ECD | electron capture detector |
| ER-L | effects range-low |
| ER-M | effects range-mid |
| FORSCOM | Forces Command |
| Ft. Dix | Fort Dix U.S. Army Installation |
| GC/MS | gas chromatography/mass spectroscopy |
| GFAA | graphite furnace atomic absorption spectroscopy |
| GGS | Geotechnical Groundwater Stabilized |
| GMA | Geotechnical Map File |
| GPR | ground penetrating radar |

## GLOSSARY OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| HASP | Health and Safety Plan |
| HCL | hydrochloric acid |
| HSA | hollow-stem auger |
| HSO | Health and Safety Officer |
| HSS | Health and Safety Supervisor |
| ICAP | inductively coupled argon emission plasma spectroscopy |
| ID | inside diameter |
| IRDMIS | Installation Restoration Data Management Information System |
| IRMs | Interim Reference Materials |
| LOC | levels of concern |
| MAG-1 | Magazine Area 1 |
| MDL | method detection limit |
| mph | miles per hour |
| NAPL | non-aqueous phase liquid |
| NBS | National Bureau of Standards |
| NIST | National Institute of Standards and Technical |
| NJDEPE | New Jersey Department of Environmental Protection and Energy |
| NTU | National Turbidity Unit |
| OD | outside diameter |
| ORP | oxidation-reduction potential |
| OVA | Organic Vapor Analyzer |
| OVM | organic vapor meter |
| PAL | Project Analyte List |
| PCB | polychlorinated biphenyl |
| PCR | Performance and Cost Report |
| PDC | Program Data Coordinator |
| PE | performance evaluation |
| PID | photoionization detector |
| PL | Pinelands Commission |
| PQL | practical quantitation limits |
| PRC | Project Review Committee |
| PRI | Potomac Research Institute |
| PVC | polyvinyl chloride |
| QA | quality assurance |
| QAC | Quality Assurance Coordinator |
| QAPP | Quality Assurance Project Plan |

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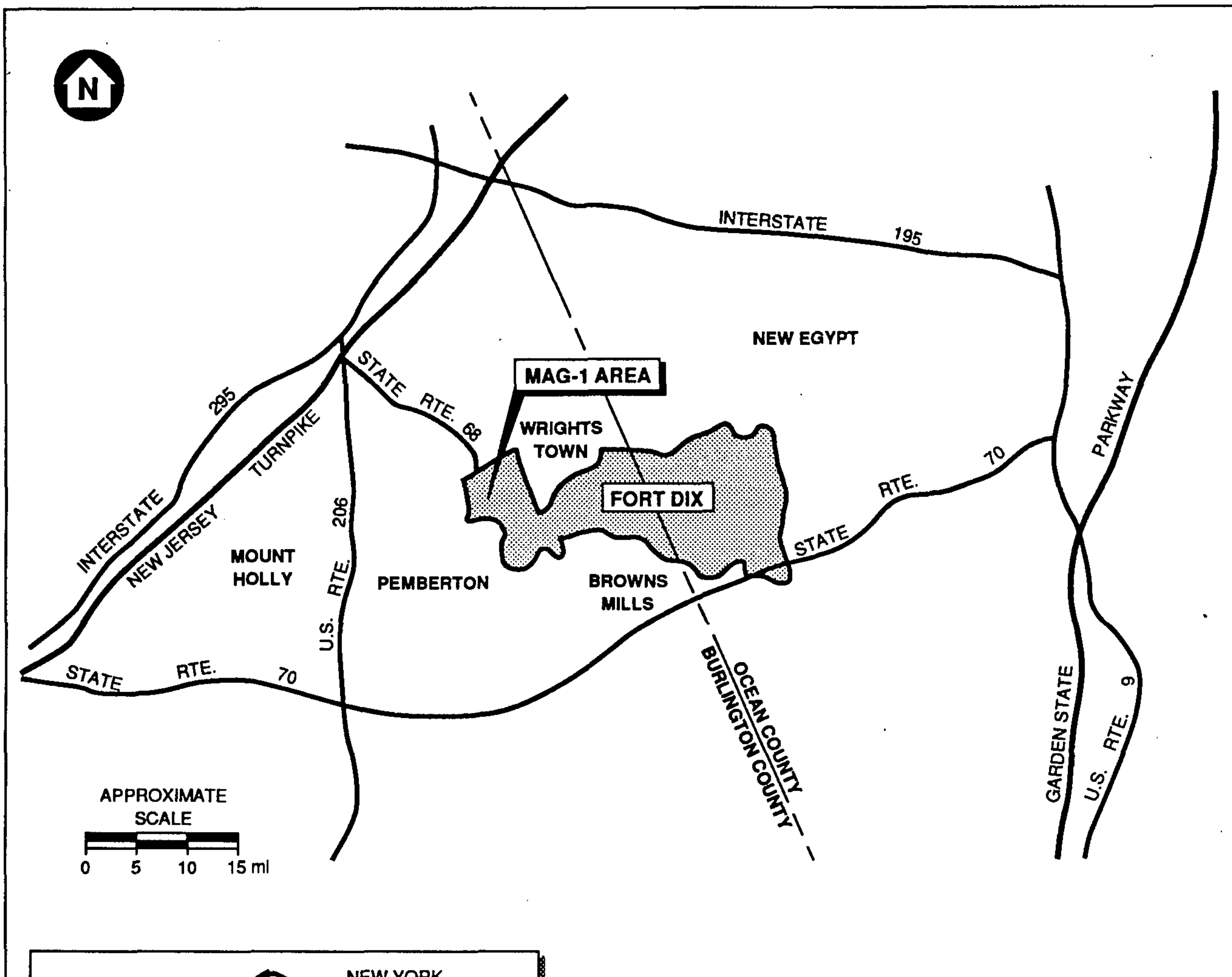
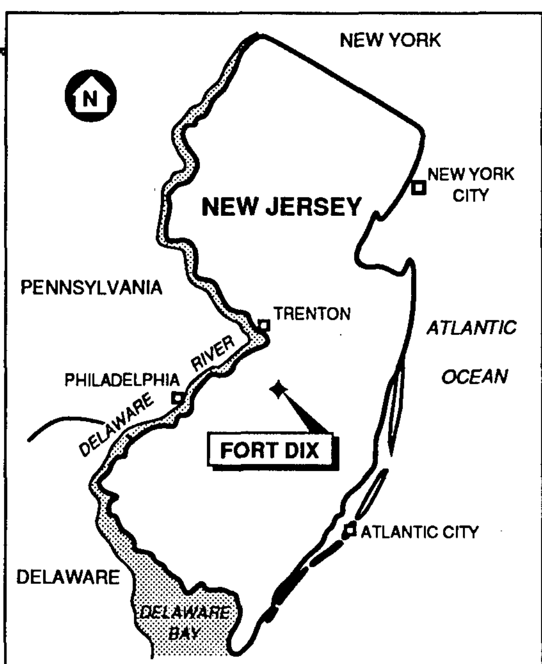



SOURCE: DAMES AND MOORE, 1993.

**FIGURE 2-1**
**MAG-1 LOCATION AT FORT DIX**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

ABB Environmental Services, Inc.

9310013D(A) 1

# TEST PIT RECORD

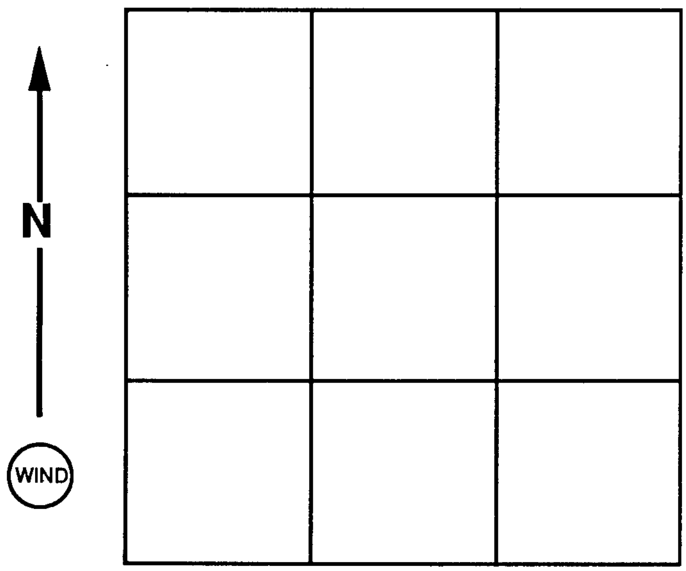


Site: ______________________________

Well/Boring ______________ Date ______________ Time ______________ End ______

Coordinates ______________________ Grid Element ______________________

SKETCH MAP OF TEST PIT SITE




SCALE 1" =__________FT.

***NOTES:*** ______________________________

Crew Members:

1.

2.

3.

4.

5.

6.

Monitor Equipment:

| | | |
|---|---|---|
| PI Meter | Y | N |
| Explosive Gas | Y | N |
| Avail. Oxygen | Y | N |
| OVA | Y | N |
| Other ______ | | |

Photogoraphs, Roll ______

Exposure ______

**FIGURE 2-2**
**TEST PIT RECORD**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

**ABB Environmental Services, Inc.**

9310002D (B)

# TEST PIT RECORD



**Profile Along Test Pit:** ____________________

Site: ____________________

SKETCH MAP OF TEST PIT PROFILE

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |

SCALE 1" = ____________FT.
DEPTH (FT).____________

***NOTES:*** ____________________

| no. | Int. Ser. No. | Depth (Ft.) | HD. SP. VOA PPM |
|---|---|---|---|
| S-1 | | | |
| S-2 | | | |
| S-3 | | | |
| S-4 | | | |
| S-5 | | | |
| S-6 | | | |
| S-7 | | | |
| S-8 | | | |
| | | | |
| | | | |

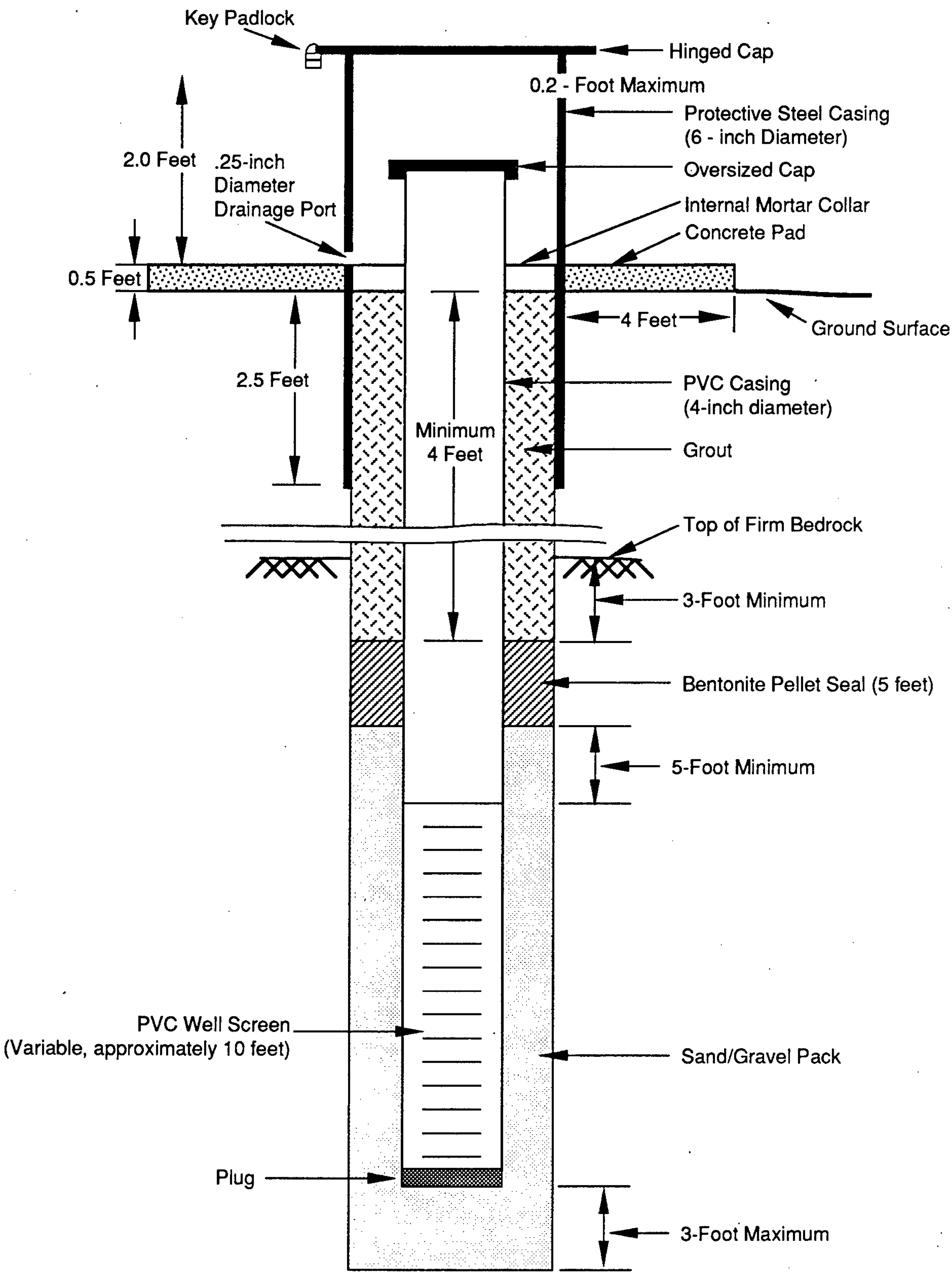
REFERENCE: FIELD BOOK, Pg.________

ATTACHMENTS________

SIGNATURE: ____________________

**FIGURE 2-2 (CONT.)**
**TEST PIT RECORD**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

## MONITORING WELL INSTALLATION DIAGRAM




***Not to Scale***

**FIGURE 2-3**
**MONITORING WELL INSTALLATION DIAGRAM**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

ABB Environmental Services, Inc.

9310002D (E)

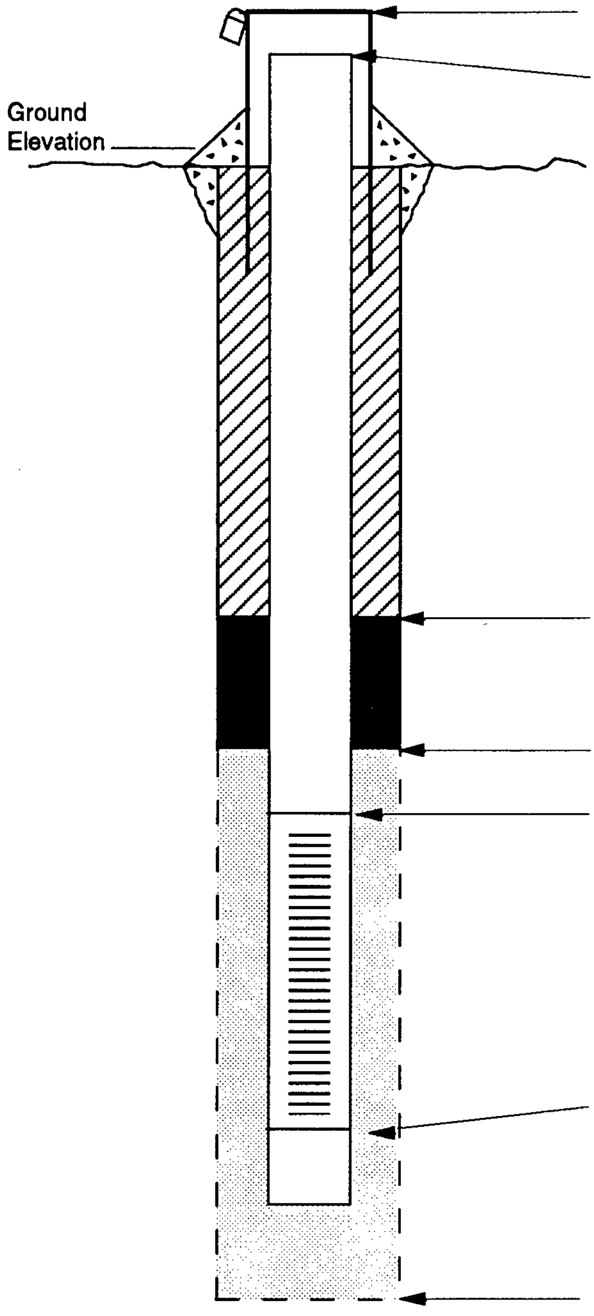
# MONITORING WELL CONSTRUCTION DIAGRAM

Project ____________________ Study Area ________________ Driller ______________________________

Project No. ________________ Boring No. ________________ Drilling Method ______________________

Date Installed ______________ Development Method _________________

Field Geologist ____________________________________________




Elevation of Top of Surface Casing: ____________

Stick-up of Casing Above Ground Surface: ________

Elevation of Top of Riser Pipe: ____________

Type of Surface Seal: ________________

Type of Surface Casing: ________________

ID of Surface Casing: ________________

Diameter of Borehole: ________________

Riser Pipe ID: ________________

Type of Riser Pipe: ________________

Type of Backfill: ________________

________________________________

________________________________

Elevation of Top of Seal: ________________

Depth of Top of Seal: ________________

Type of Seal: ________________

Elevation of Top of Sand: ________________

Depth of Top of Sand: ________________

Elevation of Top of Screen: ________________

Depth of Top of Screen: ________________

Type of Screen: ________________

Slot Size x Length: ________________

ID of Screen: ________________

Type of Sandpack: ________________

Elevation of Bottom of Screen: ____________

Depth of Bottom of Screen: ____________

Depth of Sediment Sump with Plug: ________

Elevation of Bottom of Borehole: ____________

Depth of Bottom of Borehole: ____________

**FIGURE 2-4**
**MONITORING WELL CONSTRUCTION DIAGRAM**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**


**ABB Environmental Services, Inc.**

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: | Well Installation Date: | | Project No. |
| Client: | Well Development Date: | Logged by: | Checked by: |
| Well/Site I.D.: | Weather: | Start Date: | Finish Date: |
| Initial Water Level (ft): | Bottom of Well (ft) | Start Time: | Finish Time: |
| Water Level during Initial Pumping/Purging (ft): | | | |
| Water Level at Termination of Pumping/Purging (ft): | | | |

| | Time | Temp. | DO | Turbidity | pH | Conductivity | Approximate Pumping Rate (gal/min) |
|---|---|---|---|---|---|---|---|
| BEGINNING OF WELL DEVELOPMENT | | | | | | | |
| FIRST WELL VOLUME | | | | | | | |
| SECOND WELL VOLUME | | | | | | | |
| THIRD WELL VOLUME | | | | | | | |
| FOURTH WELL VOLUME | | | | | | | |
| FIFTH WELL VOLUME | | | | | | | |
| END OF WELL DEVELOPMENT | | | | | | | |

**NOTES:**

Well Developer's Signature ______________________________

**FIGURE 2-5**
**WELL DEVELOPMENT RECORD**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

ABB Environmental Services, Inc.

9310002D (F)

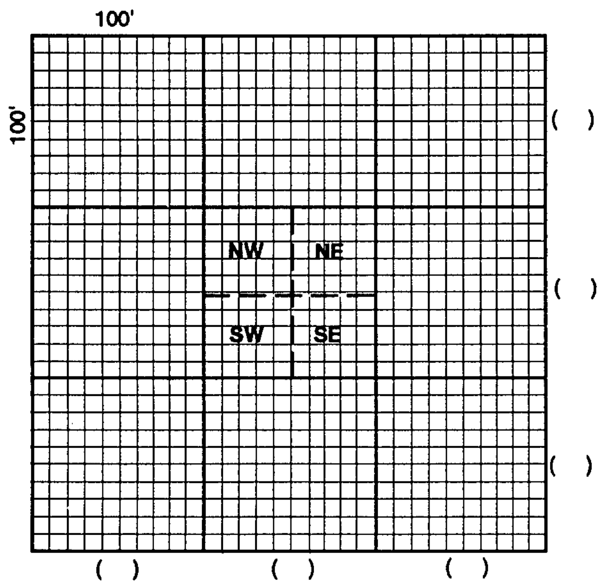
# SURFACE SOIL SAMPLING RECORD

Study Area ______________________________

Grid Element; ________ Date; ________ Time: ________ St., ________ End. ________

Sample Component Loss
-Description- -Monitoring-
-PPM-

Sketch Map of Grid Element




NE Surface PPM, Spoils PPM

Depth (Ft.) 0 1 2

NW Surface PPM, Spoils PPM

0 1 2

NW Surface PPM, Spoils PPM

0 1 2

SE Surface PPM, Spoils PPM

0 1 2

Samples Obtained

Composite Samples

| Depth (Ft) | Quadrants | Init. Ser No. | Hd. Sp. PPM |
|---|---|---|---|
| S | NE NW SE SW | | |
| 1' | NE NW SE SW | | |
| 1.5' | NE NW SE SW | | |
| 2' | NE NW SE SW | | |

Grab Samples

| | | | |
|---|---|---|---|
| | NE NW SE SW | | |
| | NE NW SE SW | | |
| | NE NW SE SW | | |
| | NE NW SE SW | | |

Notes: ______________________________ Photographers Roll: ________
______________________________ Exposures: ________
______________________________
______________________________
______________________________ Reference: Field Book, Page ________

Attachments, No. ________
Signed________

**FIGURE 2-6**
**SURFACE SOIL SAMPLE RECORD**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**
**ABB Environmental Services, Inc.**

9310002D (H)

# SOIL SAMPLE FIELD DATA RECORD

Project: USAEC - Ft. Dix  Site: MAG-1 Area

Project Number: 7134-04  Date: ____________

Site ID: [ | | | | | | | ]  Time: Start: ________ End: ________

Field Sampling No.: [ | | | | | | | | ]  Signature of Sampler: ____________

***SOIL SAMPLE***

DEPTH OF SAMPLE ____________

EQUIPMENT USED FOR COLLECTION:
[ ] HAND AUGER
[ ] SPLIT SPOON
[ ] SHOVEL
[ ] HAND SPOON
[ ] SS PAN
[ ] SS BUCKET
[ ] SS SPATULA
[ ] ____________

TYPE OF SAMPLE COLLECTED:
[ ] DISCRETE
[ ] COMPOSITE

SAMPLE OBSERVATIONS:
[ ] ODOR ____________
[ ] COLOR ____________
[ ] ____________

DECONTAMINATION FLUIDS USED:
✓ ALL USED
[ ] METHANOL (100%)
[ ] 25% METHANOL/ 75% ASTM TYPE II WATER
[ ] HEXANE
[ ] DEIONIZED WATER
[ ] LIQUINOX SOLUTION
[ ] $HNO_3$ SOLUTION
[ ] POTABLE WATER
[ ] NONE

SOIL TYPE:
[ ] CLAY
[ ] SAND
[ ] ORGANIC
[ ] GRAVEL

FIELD GC DATA: [ ] FIELD GC SAMPLE
[ ] FIELD DUPLICATE COLLECTED
DUPLICATE ID ____________

SAMPLE LOCATION SKETCH:
[ ] YES
[ ] NO

***SAMPLES COLLECTED***

| Analytical Parameter | ✓ If Sample Collected | Preservation Method | Volume Required | Sample Bottle IDs |
|---|---|---|---|---|
| VOA | [ ] | 4°C | 2x125ml AG | ____/____ |
| SVOA | [ ] | 4°C | 2x0.25 liter AG | ____/____ |
| Metals | [ ] | 4°C | | |
| Lead | [ ] | 4°C | | |
| Explosives | [ ] | 4°C | | |
| TPH | [ ] | 4°C | | |
| Oil & Grease | [ ] | 4°C | | |
| TOC | [ ] | 4°C | | |
| ________ | [ ] | ____ | ________ | ____/____/____/____ |

***NOTES/SKETCH***

**FIGURE 2-7**
**SOIL SAMPLE FIELD DATA RECORD**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**
**ABB Environmental Services, Inc.**

| **SOIL BORING LOG** | | | | Study Area: |
|---|---|---|---|---|
| | | | | Boring No.: |
| Client: | | Project No. | | Protection: |
| Contractor: | Date Started: | | | Completed: |
| Method: | Casing Size: | | | PI Meter: |
| Ground Elev.: | Soil Drilled: | | | Total Depth: |
| Logged by: | Checked by: | | | ▽ Below Ground: |
| Screen: (ft.) | Riser: (ft.) | Diam: (ID) | Material: | Page of: |

| DEPTH (FT) | SAMPLE NUMBER | SAMPLE DEPTH | CLP/SCREENING | RECOVERY | PID (ppm) | SOIL/ROCK DESCRIPTION | SOIL CLASS | BLOWS/6-IN. | WELL DATA | LITHOLOGY | ELEVATION (FT.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |

| PROPORTIONS | (-) AMOUNT (+) |
|---|---|
| Trace (tr) | 0-10% |
| Little (ll) | 10-20% |
| Some (so) | 20-35% |
| and | 35-50% |

ABBREVIATIONS

| | | |
|---|---|---|
| f = fine | gr = gray | MS = Split Spoon |
| m = medium | bn = brown | BW = Screened Auger |
| c = coarse | blk = black | HP = Hydropunch |

**FIGURE 2-8**
**SOIL BORING LOG**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**
**ABB Environmental Services, Inc.**

9310002D (J)

# SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: USAEC - Ft. Dix
Project Number: 7134-04
Site ID: [ ][ ][ ][ ][ ][ ]
Field Sampling No.: [ ][ ][ ][ ][ ][ ][ ][ ]

Site: MAG-1 Area
Date: ______
Time: Start: ______ End: ______
Signature of Sampler: ______

***SURFACE WATER INFORMATION***

WATER DEPTH AND SAMPLE LOCATION ______ (ft)

DEPTH OF SAMPLE
FROM TOP OF WATER ______ (ft)

TYPE OF SURFACE WATER:
[ ] STREAM [ ] RIVER
[ ] POND/LAKE [ ] SEEP

EQUIPMENT USED FOR COLLECTION:
[ ] NONE, GRAB INTO BOTTLE
[ ] BOMB SAMPLER
[ ] PUMP ______

DECONTAMINATION FLUIDS USED:
✓ ALL USED
[ ] ETHYL ALCOHOL
[ ] 25% METHANOL/ 75% ASTM TYPE II WATER
[ ] DEIONIZED WATER
[ ] LIQUINOX SOLUTION
[ ] HEXANE
[ ] $HNO_3$ SOLUTION
[ ] POTABLE WATER
[ ] NONE

VELOCITY MEASUREMENTS OBTAINED? [ ] YES, SEE FLOW MEASUREMENT DATA RECORD ______

TEMPERATURE ______ Deg. C. SPEC. COND. ______ µmhos/cm pH ______ Units DISS. $O_2$ ______ ppm

FIELD GC DATA: [ ] FIELD DUPLICATE COLLECTED
DUPLICATE ID ______
[ ] FIELD GC SAMPLE

SAMPLE LOCATION SKETCH:
[ ] YES
[ ] NO

METHOD USED:
[ ] WINKLER
[ ] PROBE

***SEDIMENT INFORMATION***

DEPTH OF SEDIMENT SAMPLE ______ (ft)

EQUIPMENT USED FOR COLLECTION:
[ ] GRAVITY CORER
[ ] SPLIT SPOON
[ ] DREDGE
[ ] HAND SPOON
[ ] SS PAN
[ ] SS BUCKET
[ ] SS SPATULA

TYPE OF SAMPLE COLLECTED:
[ ] DISCRETE
[ ] COMPOSITE

SAMPLE OBSERVATIONS:
[ ] ODOR ______
[ ] COLOR ______
[ ] ______

DECONTAMINATION FLUIDS USED:
✓ ALL USED
[ ] METHANOL (100%)
[ ] 25% METHANOL/ 75% ASTM TYPE II WATER
[ ] HEXANE
[ ] DEIONIZED WATER
[ ] LIQUINOX SOLUTION
[ ] $HNO_3$/D.I. WATER SOLUTION
[ ] POTABLE WATER
[ ] NONE

SEDIMENT TYPE:
[ ] CLAY
[ ] SAND
[ ] ORGANIC
[ ] GRAVEL

FIELD GC DATA: [ ] FIELD DUPLICATE COLLECTED
DUPLICATE ID ______

***SAMPLES COLLECTED***

| ANALYTICAL PARAMETER | SAMPLES COLLECTED: SURFACE WATER | SAMPLES COLLECTED: SEDIMENT | SURFACE WATER PRESERVATION | VOLUME REQUIRED WATER/SOIL | SURFACE WATER SAMPLE BOTTLE IDS | SOIL SAMPLE BOTTLE IDS |
|---|---|---|---|---|---|---|
| VOA | [ ] | [ ] | HCl,4°C | 4x40 ml/2x125 ml AG | ___/___/___/___ | ___/___ |
| SVOA | [ ] | [ ] | 4°C | 2x1 liter AG/2x0.25 liter AG | ___/___ | |
| Metals | [ ] | [ ] | $HNO_3$,4°C | 1x1 liter P/ | ___ | |
| Explosives | [ ] | [ ] | 4°C | 2x1 liter AG/ | ___/___ | |
| Pest/PCB | [ ] | [ ] | 4°C | 3x1 liter AG/ | ___/___/___ | ___/___ |
| TOC | [ ] | [ ] | $H_2SO_4$,4°C | 1x1 liter P/ | ___ | |
| ______ | [ ] | [ ] | ______ | ______ | ___/___/___/___ | |

***NOTES/SKETCH***

**FIGURE 2-9**
**SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

**ABB Environmental Services, Inc.**

# SEDIMENT CORE LOG

| | | |
|---|---|---|
| | | Study Area: |
| | | Site ID: |
| Client: | Project No. | Protection: |
| Contractor: | Date Started: | Completed: |
| Method: | Core Tube Size: | PI Meter: |
| Logged by: | Checked by: | Total Depth: |
| | | Page of: |

| DEPTH (FT) | REFERENCE SAMPLE NUMBER | SAMPLE DEPTH | RECOVERY | PID (ppm) | SEDIMENT DESCRIPTION | SOIL CLASS |
|---|---|---|---|---|---|---|
| | | | | | | |

FIGURE 2-10
SEDIMENT CORE LOG
QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA
ABB Environmental Services, Inc.

9310002D (Q)

## FIELD INSTRUMENTATION & MATERIAL QUALITY ASSURANCE RECORD

Project ______________ Site ______________________________________________

Project No. ____________ Sampler Signature________________________________

Date _______________

### Field Instrumentation Calibration Data

| Equipment Type/I.D. | Battery Condition | Calibration Information |
|---|---|---|
| ____________________ | _______ | pH 4 ____ pH 7 ____ pH 10 ____ |
| ____________________ | _______ | pH 4 ____ pH 7 ____ pH 10 ____ |
| ____________________ | _______ | pH 4 ____ pH 7 ____ pH 10 ____ |
| ____________________ | _______ | Cond. Std. ____/ _____ Cond. Std. ____/ _____ |
| ____________________ | _______ | Cond. Std. ____/ _____ Cond. Std. ____/ _____ |
| ____________________ | _______ | Cond. Std. ____/ _____ Cond. Std. ____/ _____ |
| **Dissolved Oxygen** | | |
| ____________________ | _______ | Avg. Winkler Value _____ppm Meter Value _____ppm |
| **Redox** | | |
| ____________________ | _______ | Zobell Sol. Value _____ Meter Value ___ |
| **Photoionization Meter** | | |
| ____________________ | _______ | Zero/Zero Air? ❑ Yes ❑ No Span Gas Value ___ppm Equiv. |
| | | Meter Value ___ppm Equiv. |
| ____________________ | _______ | Zero/Zero Air? ❑ Yes ❑ No Span Gas Value ___ppm Equiv. |
| | | Meter Value ___ppm Equiv. |
| **Other** | | |
| ____________________ | _____ | ______________________________ |

### Fluids/Materials Record

Deionized Water Source: _____ECJ Staging Portable System Other

Trip Blank Water Source: _____ECJ Lab; Lot No. _________

___Other; Type ____________________ID ___________

Decontamination Fluids: ___Methyl Hydrate; Lot No. ____________

___Other; Type ____________________ID ___________

$HNO_3$/DI Rinse Solution: ___ECJ Staging; Lot No. _______________

Filtration Paper ID: (In Line) Manuf/Type _____________________ Lot No. ____________/ __________

(Vacuum) Manuf/Type _____________________ Lot No. ____________/ __________

Chemicals Used: $HNO_3$ Lot No. _________________ ZnAOC Lot No. ________________

$H_2SO_4$ Lot No. _________________ Other Lot No. ________________

HCL Lot No. _________________ Other Lot No. ________________

NaOH Lot No. _________________

**FIGURE 2-11**
**FIELD INSTRUMENTATION AND MATERIAL QUALITY ASSURANCE RECORD**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

# GROUNDWATER SAMPLE FIELD DATA RECORD

Project: USAEC - Ft. Dix
Study Area: MAG-1
Project Number: 7134-04
Date: ____
Site ID: ____
Time: Start: ____ End: ____
Field Sampling No.: ____
Signature of Sampler: ____

## Water Level/Well Data

Well Depth ____ Ft. ____ Measured ____ Historical ____ Top of Well ____ Top of Protective Casing ____ ____
Well Riser Stick-up ____ Ft. (from ground)
Protective ____ Ft. Casing/Well Difference
Protective ____ Ft. Casing

Depth to Water ____ Ft.
Well Material: ____ PVC ____ SS ____
Well Locked?: ____ Yes ____ No
Well Dia. ____ 2 inch ____ 4 inch ____ 6 inch ____ ____
Water Level Equip. Used: ____ Elect. Cond. Probe ____ Float Activated ____ Press. Transducer ____ ____

Height of Water Column ____ Ft. X ____ .16 Gal/Ft. (2 in.) ____ .65 Gal/Ft. (4 in.) ____ 1.5 Gal/Ft. (6 in.) ____ ____ Gal/Ft. (__in.) = [ ____ Gal/Vol. ____ Total Gal Purged ]

| Well Integrity: | Yes | No |
|---|---|---|
| Prot. Casing Secure | ____ | ____ |
| Concrete Collar Intact | ____ | ____ |
| Other ____ | ____ | ____ |

## Equipment Documentation

**Purging/Sampling Equipment Used**:

(✓ If Used For)

| Purging | Sampling | | Equipment ID |
|---|---|---|---|
| __ | __ | Peristaltic Pump | ____ |
| __ | __ | Submersible Pump | ____ |
| __ | __ | Bailer | ____ |
| __ | __ | PVC/Silicon Tubing | ____ |
| __ | __ | Teflon/Silicon Tubing | ____ |
| __ | __ | Airlift | ____ |
| __ | __ | Hand Pump | ____ |
| __ | __ | In-line Filter | ____ |
| __ | __ | Press/Vac Filter | ____ |
| __ | __ | | ____ |

**Decontamination Fluids Used**:

(✓ All That Apply at Location)

- ____ Methanol (100%)
- ____ 25% Methanol/75% ASTM Type II water
- ____ Hexane
- ____ Deionized Water
- ____ Liquinox Solution
- ____ $HNO_3$/D.I. Water Solution
- ____ Potable Water
- ____ None
- ____ ____
- ____ ____

## Field Analysis Data

Ambient Air VOC ____ ppm Well Mouth ____ ppm Field Data Collected ____ In-line ____ In Container

Sample Observations: __Turbid __Clear __Cloudy __Colored __Odor

| Purge Data | @ ____ Gal. | @ ____ Gal. | @ ____ Gal. | @ ____ Gal. | @ ____ Gal. |
|---|---|---|---|---|---|
| Temperature, Deg. C | | | | | |
| pH, units | | | | | |
| Specific Conductivity | | | | | |
| Turbidity (NTU) | | | | | |
| Oxidation - Reduction, +/- mv | | | | | |
| Dissolved Oxygen, ppm | | | | | |

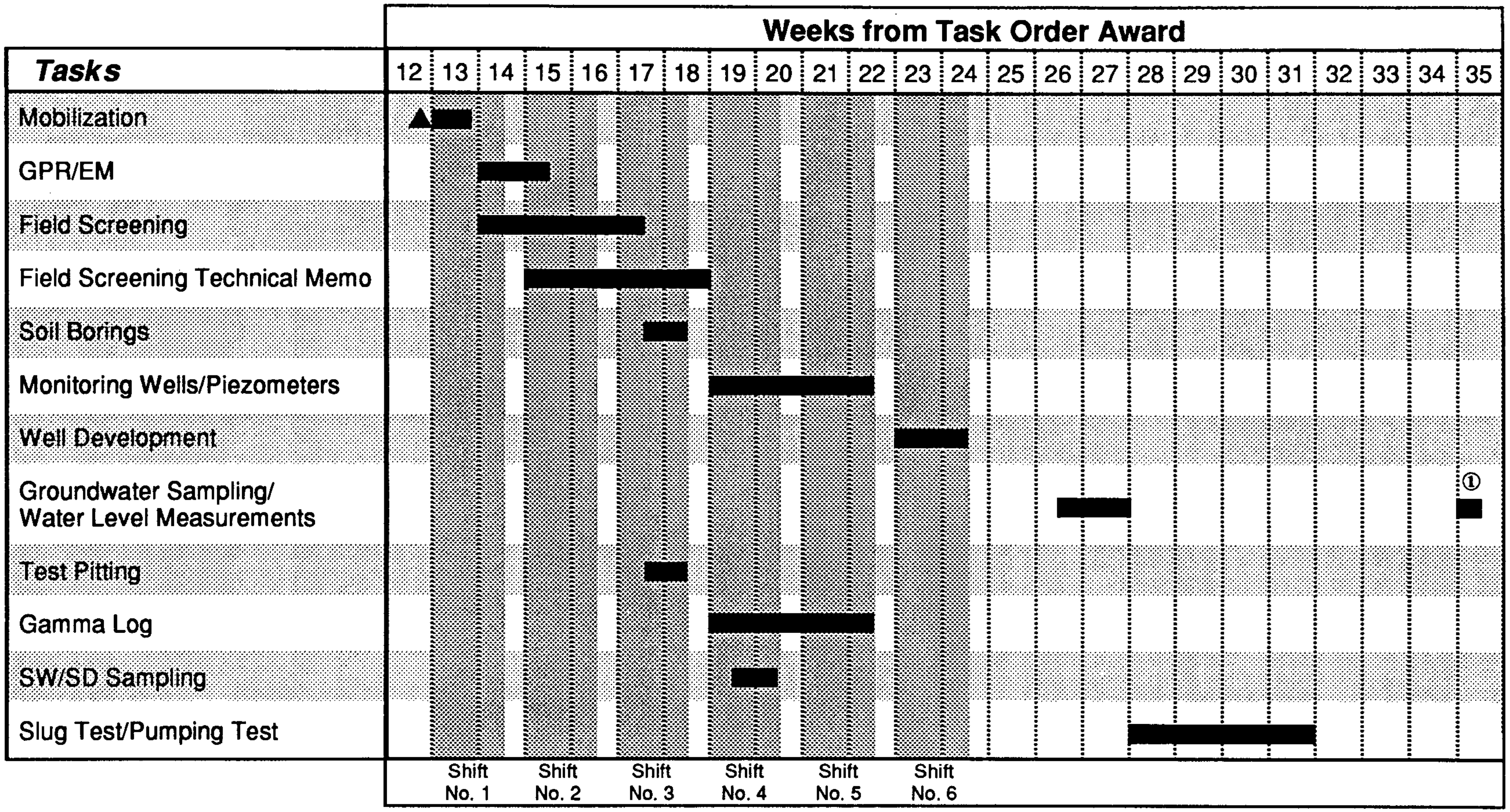
## Sample Collection Requirements (✓ If Required at this Location)

| Analytical Parameter | ✓ If Sample Collected | Preservation Method | Volume Required | Sample Bottle IDs |
|---|---|---|---|---|
| VOA | ____ | HCl,4°C | 4x40 ml AG | ____/____/____/____ |
| SVOA | ____ | 4°C | 2x1 liter AG | ____/____ |
| Metals | ____ | $HNO_3$,4°C | 1x1 liter P | ____ |
| Explosives | ____ | 4°C | 2x1 liter AG | ____/____ |
| Nitrite/Sulfate | ____ | 4°C | 1x1 liter P | ____ |
| Nitrate/Phosphate | ____ | $H_2SO_4$,4°C | 1x1 liter P | ____ |
| TOC | ____ | $H_2SO_4$,4°C | | ____ |
| Pest/PCB | ____ | 4°C | 3x1 liter AG | ____ ____/____ |
| TPH | ____ | $H_2SO_4$,4°C | 2x1 liter AG | ____/____ |
| ____ | ____ | ____ | ____ | ____/____/____/____ |

Notes: ____

**FIGURE 2-12**
**GROUNDWATER SAMPLE FIELD DATA RECORD**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**
**ABB Environmental Services, Inc.**

9312030S L22




▲ Mobilization begins 12 weeks after Authorization to Proceed

① Groundwater and surface water level measurements only

**FIGURE 2-13**
**RI FIELD ACTIVITIES**
**1993 REMEDIAL INVESTIGATION**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

ABB Environmental Services, Inc.

9306027D

# AQUIFER TEST COMPLETION CHECKLIST

AQUIFER TEST NO. ______

| SETUP | DATE | BY WHOM |
|---|---|---|
| MONITORING WELL ID | | |
| DATE OF TEST | | |
| TYPE OF TEST | | |
| HERMIT TYPE/SERIAL# | | |
| TEST # | | |
| DATA COLLECTION RATE | | |
| **TRANSDUCER** | | |
| SERIAL # | | |
| PSIG | | |
| SCALE FACTOR | | |
| OFFSET | | |
| INPUT CHANNEL | | |
| **TEST DATA** | | |
| INPUT MODE (TOC/SUR) | | |
| STATIC WATER LEVEL (FT./TOC) | | |
| WELL DEPTH (FT./TOC) | | |
| XD DEPTH (FT.TOC) | | |
| INITIAL XD REFERENCE | | |
| SLUG DEPTH (FT./TOC) | | |
| TIME OF SLUG PLACEMENT | | |
| TIME OF WL EQUILIBRATION | | |
| NEW XD REFERENCE | | |
| START TIME OF TEST | | |
| END TIME OF TEST | | |
| NOTES: | | |

**FIGURE 2-14**
**AQUIFER TEST COMPLETION CHECKLIST**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**
**ABB Environmental Services, Inc.**

9310002D (0)

# Field Permeability Test Data Sheet

| | | |
|---|---|---|
| Project No. | Project Name: | Well No.: |
| Performed by: | Date: | Type of Test: |
| Borehole Dia. (in.): | Well dia. I.D. (in.): | Total Test Time: |
| Depth to static water level (ft.): | | Page ___ of ___ |

**All Measurements Taken from Top of Riser**

| Time | Elapsed Time | Depth to Water | ΔH | Comments |
|---|---|---|---|---|
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**FIGURE 2-15**
**FIELD PERMEABILITY TEST DATA SHEET**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

**ABB Environmental Services, Inc.**

9310002D (P)

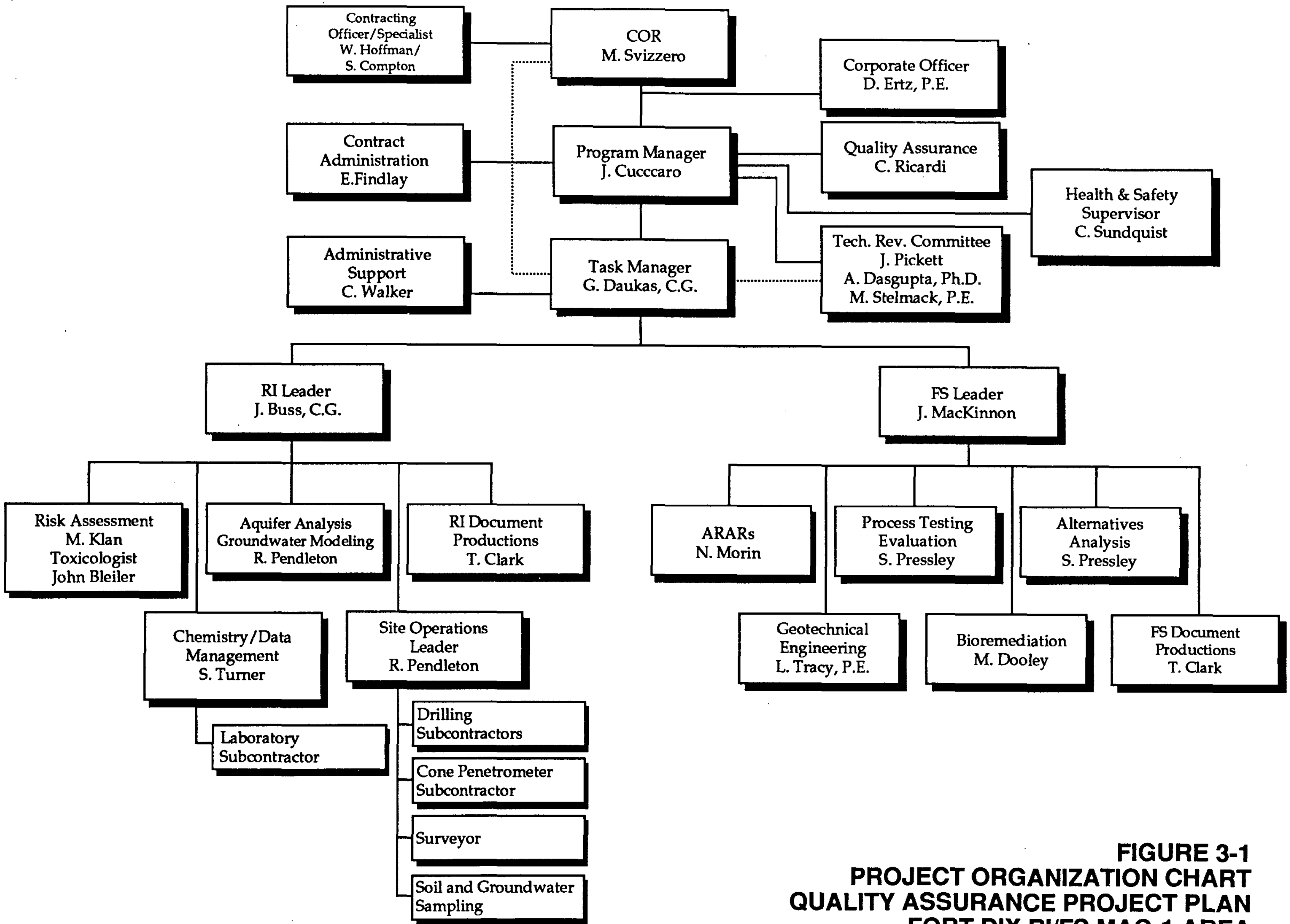


**FIGURE 3-1**
**PROJECT ORGANIZATION CHART**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

9306018D

**ABB Environmental Services, Inc.**

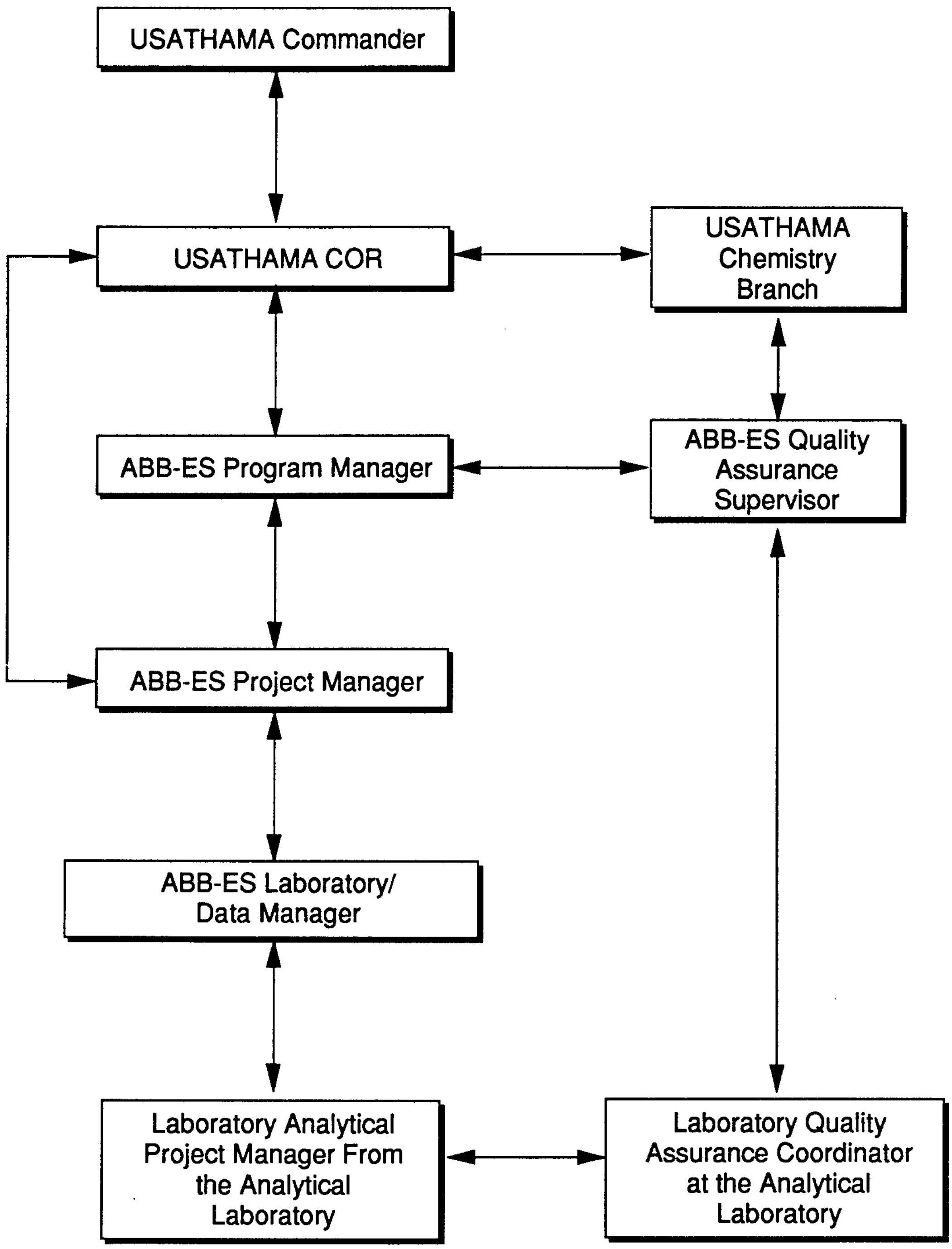


**FIGURE 3-2**
**QA/QC FUNCTIONAL ORGANIZATION CHART**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

**ABB Environmental Services, Inc.**

9310002D(A)

COMPUTERIZED LABLES

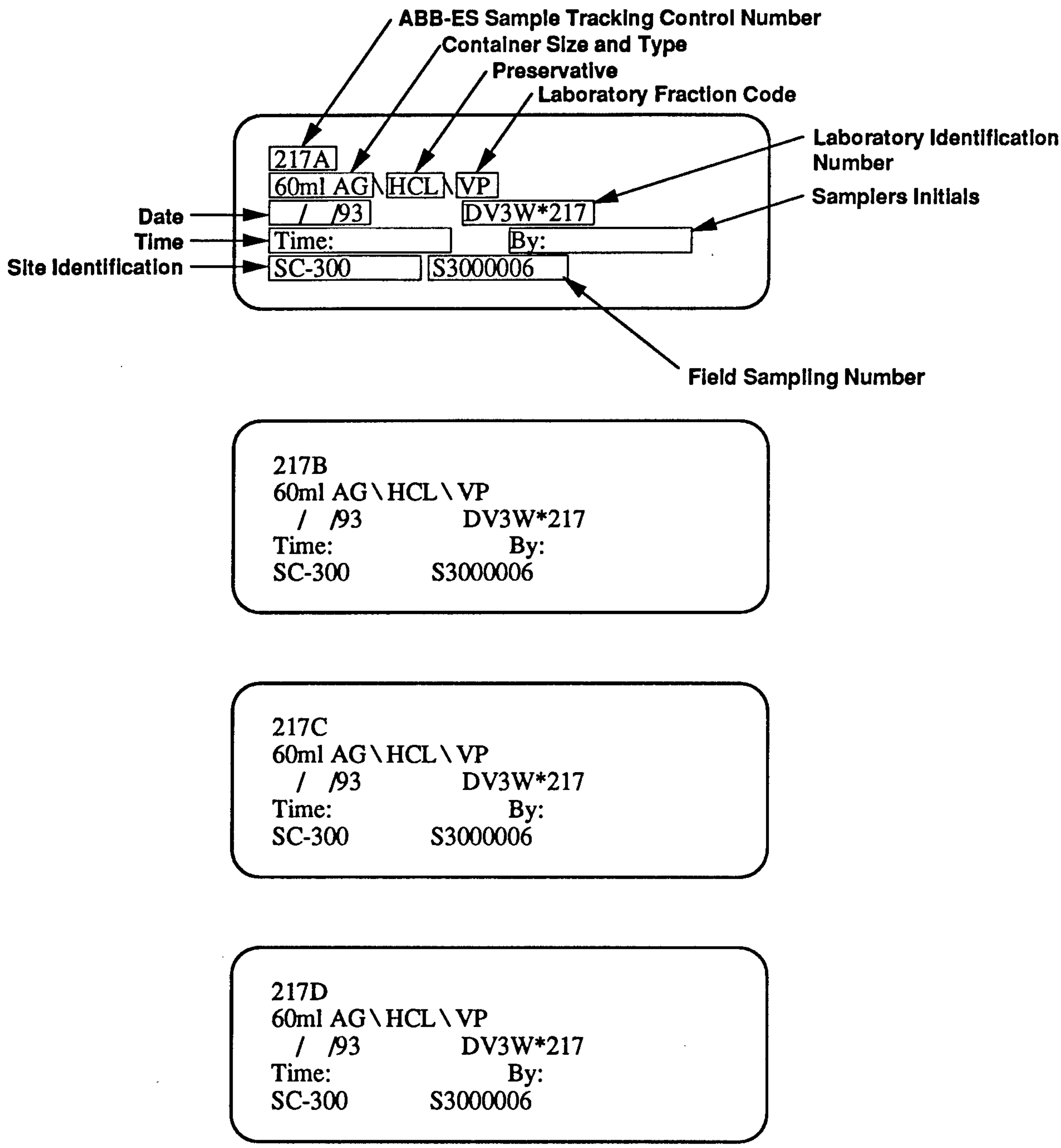


**FIGURE 5-1**
**COMPUTERIZED LABELS**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

ABC COMPANY
DATE: TIME:

| SAMPLE ID | CLIENT ID | NOTES | PARAMETER | | CONTAINER | PRESERVED | ABB-ES SERIAL | DATE SAMPLED |
|---|---|---|---|---|---|---|---|---|
| MW-101 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 100 | |
| MW-101 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 101 | |
| MW-101 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 102 | |
| MW-101 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 103 | |
| MW-101 | ABB Environmental Services Inc. | | DISSOLVED ORG. CARBON | FILT | 60 ML. | HCL | 104 | |
| MW-101 | ABB Environmental Services Inc. | | DIS. FE/CU/CD/MN | FILT | 250 ML. | HNO3 | 105 | |
| MW-102 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 106 | |
| MW-102 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 107 | |
| MW-102 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 108 | |
| MW-102 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 109 | |
| MW-102 | ABB Environmental Services Inc. | | DISSOLVED ORG. CARBON | FILT | 60 ML. | HCL | 110 | |
| MW-102 | ABB Environmental Services Inc. | | DIS. FE/CU/CD/MN | FILT | 250 ML. | HNO3 | 111 | |
| MW-103 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 112 | |
| MW-103 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 113 | |
| MW-103 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 114 | |
| MW-103 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 115 | |
| MW-103 | ABB Environmental Services Inc. | | DISSOLVED ORG. CARBON | FILT | 60 ML. | HCL | 116 | |
| MW-103 | ABB Environmental Services Inc. | | DIS. FE/CU/CD/MN | FILT | 250 ML. | HNO3 | 117 | |
| MW-104 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 118 | |
| MW-104 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 119 | |
| MW-104 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 120 | |
| MW-104 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 121 | |
| MW-104 | ABB Environmental Services Inc. | | DISSOLVED ORG. CARBON | FILT | 60 ML. | HCL | 122 | |
| MW-104 | ABB Environmental Services Inc. | | DIS. FE/CU/CD/MN | FILT | 250 ML. | HNO3 | 123 | |
| MW-105 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 124 | |
| MW-105 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 125 | |
| MW-105 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 126 | |
| MW-105 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 127 | |
| MW-105 | ABB Environmental Services Inc. | | DISSOLVED ORG. CARBON | FILT | 60 ML. | HCL | 128 | |
| MW-105 | ABB Environmental Services Inc. | | DIS. FE/CU/CD/MN | FILT | 250 ML. | HNO3 | 129 | |
| SW-4 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 130 | |
| SW-4 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 131 | |
| SW-4 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 132 | |
| SW-4 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 133 | |
| SW-4 | ABB Environmental Services Inc. | | DISSOLVED ORG. CARBON | FILT | 60 ML. | HCL | 134 | |
| SW-4 | ABB Environmental Services Inc. | | DIS. FE/CU/CD/MN | FILT | 250 ML. | HNO3 | 135 | |
| SW-5 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 136 | |
| SW-5 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 137 | |
| SW-5 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 138 | |
| SW-5 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 139 | |
| SW-5 | ABB Environmental Services Inc. | | DISSOLVED ORG. CARBON | FILT | 60 ML. | HCL | 140 | |
| SW-5 | ABB Environmental Services Inc. | | DIS. FE/CU/CD/MN | FILT | 250 ML. | HNO3 | 141 | |
| SW-6 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 142 | |
| SW-6 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 143 | |
| SW-6 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 144 | |
| SW-6 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 145 | |
| SW-6 | ABB Environmental Services Inc. | | DISSOLVED ORG. CARBON | FILT | 60 ML. | HCL | 146 | |
| SW-6 | ABB Environmental Services Inc. | | DIS. FE/CU/CD/MN | FILT | 250 ML. | HNO3 | 147 | |
| DUPLICATE-1 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 148 | |
| DUPLICATE-1 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 149 | |
| DUPLICATE-1 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 150 | |
| DUPLICATE-1 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 151 | |
| DUPLICATE-1 | ABB Environmental Services Inc. | | DISSOLVED ORG. CARBON | FILT | 60 ML. | HCL | 152 | |
| DUPLICATE-1 | ABB Environmental Services Inc. | | DIS. FE/CU/CD/MN | FILT | 250 ML. | HNO3 | 153 | |
| DUPLICATE-2 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 154 | |
| DUPLICATE-2 | ABB Environmental Services Inc. | | VOLATILE ORG. #624 | | 40 ML. | 4 DEG. C | 155 | |
| DUPLICATE-2 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 156 | |
| DUPLICATE-2 | ABB Environmental Services Inc. | | EXT. ORGANICS #625 | | 1000 ML. | 4 DEG. C | 157 | |
| DUPLICATE-2 | ABB Environmental Services Inc. | | DISSOLVED ORG. CARBON | FILT | 60 ML. | HCL | 158 | |
| DUPLICATE-2 | ABB Environmental Services Inc. | | DIS. FE/CU/CD/MN | FILT | 250 ML. | HNO3 | 159 | |

**FIGURE 5-2**
**SAMPLE MANIFEST**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

**ABB Environmental Services, Inc.**

# CHAIN OF CUSTODY RECORD

Page____ of ____

| PROJECT NO. | PROJECT NAME | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FIELD SAMPLE CUSTODIAN | | | | NUMBER OF CONTAINERS | SAMPLE CONTAINER TYPE | | | | | | MATRIX INDICATE SOIL/WATER/AIR SEDIMENT/SLUDGE |
| DATE | TIME | SITE SAMPLE ID | FIELD SAMPLE ID | | 40-ML VIAL | 1-LITER PLASTIC | 1-LITER AMBER | 4-OZ AMBER WIDE MOUTH | | | |
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|---|---|---|---|---|---|
| RELINQUISHED BY: (SIGNATURE) | DATE/TIME | RECEIVED BY: (SIGNATURE) | RELINQUISHED BY: (SIGNATURE) | DATE/TIME | RECEIVED BY: (SIGNATURE) |
| RELINQUISHED BY: (SIGNATURE) | DATE/TIME | RECEIVED BY: (SIGNATURE) | RELINQUISHED BY: (SIGNATURE) | DATE/TIME | RECEIVED BY: (SIGNATURE) |
| RELINQUISHED BY: (SIGNATURE) | DATE/TIME | RECEIVED FOR DISPOSAL BY: (SIGNATURE) | DATE/TIME | REMARKS | |

**ABB Environmental Services, Inc.**
*Portland Office:* P. O. BOX 7050
Portland, ME 04112

**FIGURE 5-3**
**CHAIN-OF-CUSTODY RECORD**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

9310002D (T)

# ANALYTICAL REQUEST FORM

**ABB Environmental Services, Inc.**

Client :

Purchase Order/Job Number ____________

Where to Send Report: **ABB-ES**
P.O.Box 7050
Portland, ME 04112

Analyses Requested By: ____________
Field Operations Leader

Date Received ____________
Lab Location ____________
Results Due ____________
Client ID No. ____________

☐ Solid Waste Data File
☐ Data Documentation Required
☐ Entered in Computer

Type of Sample ____________

List Any Hazards ____________

Additional Information or Special Procedures ____________

| | | | | Analyses Required | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site Sample ID | Field Sample ID | Date Sampled | Sampled by | VOC | SVOC | INORGANICS | EXPLOSIVES | TPHC | TOC | ALKALINITY | CARBONATE/ BICARBONATE | TOTAL NITRATE | TSS | TCLP | COLIFORM | | | | | |
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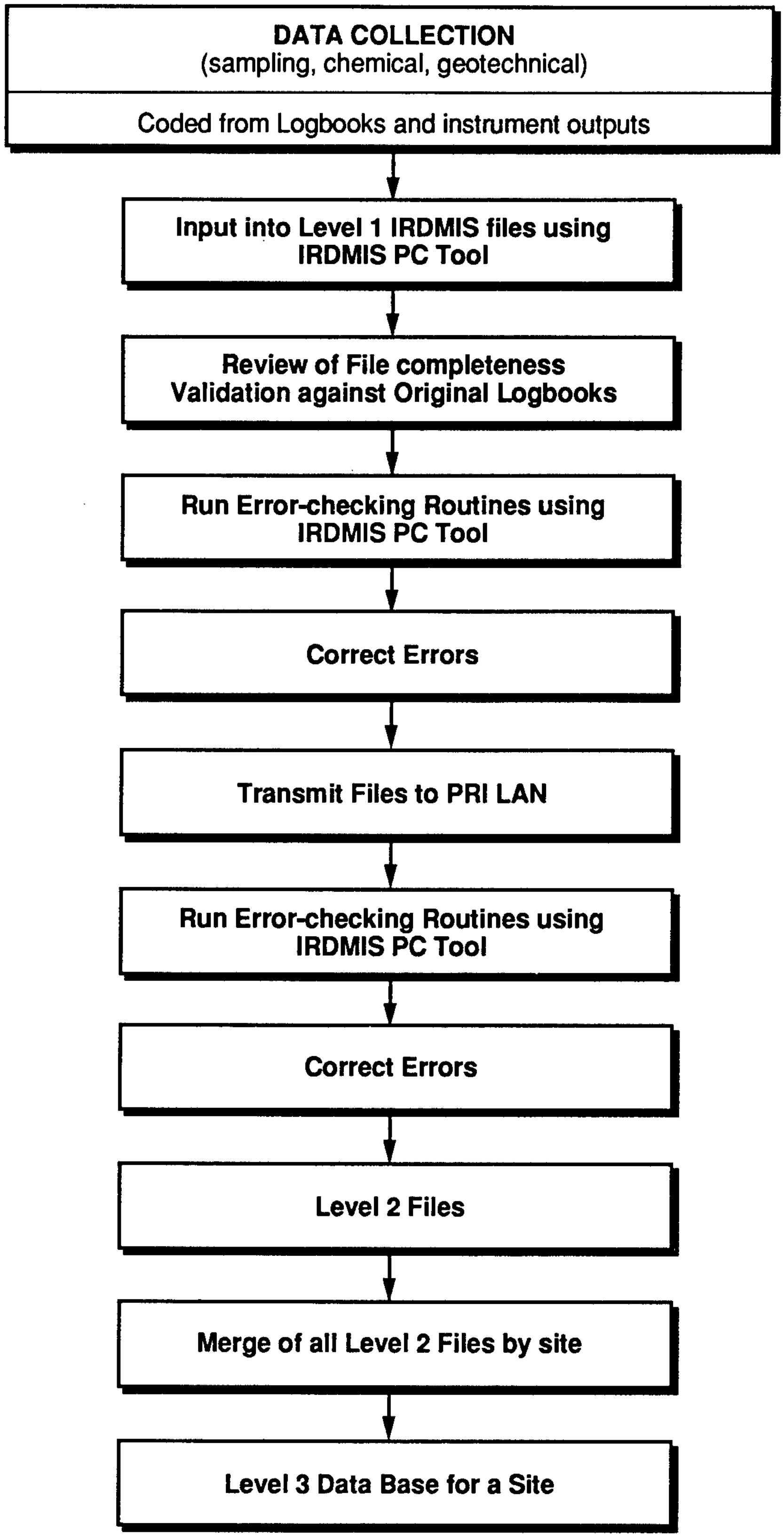
9310002D (U)

**FIGURE 5-4**
**ANALYTICAL REQUEST FORM**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**




SOURCE: ICF KAISER ENGINEERS, 1993b.

**FIGURE 7-1**
**DATA MANAGEMENT SCHEME**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

## PROJECT REVIEW RECORD

Project Name: Date:

Project No.: Project Professional:

Site/Location:

Client:

Project Type: Department:

Objective of the Review:

Reviewers:

Consensus Review comments:

1.

2.

3.

FIGURE 11-1
PROJECT REVIEW RECORD
QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

**ABB Environmental Services, Inc.**

## PROJECT REVIEW RECORD (cont.)

4.

5.

Follow-up Actions:

1.

2.

3.

4.

5.

Date Follow-up Completed:

Project Professional: ______________________

Department Manager: ______________________

Distribute when completed to: VP-QA, Dept. Mgr., Project File, Reviewers

**FIGURE 11-1 (cont.)**
**PROJECT REVIEW RECORD**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

## QUALITY ASSURANCE AUDIT REPORT

Project: ______________________________________________

Project No.: ____________ Quality Assurance Coordinator: ________________

Project Aspects Audited: ______________________________________

Laboratory/Technical Director: ___________________________________

Audit Conducted By: __________ for the period __________ to ______________

Date of Audit: ___________________________________________

Personnel Interviewed: ________________________________________

<u>Purpose and Objectives of the Project Aspects Audited</u>

**FIGURE 11-2**
**QUALITY ASSURANCE AUDIT REPORT**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

## QUALITY ASSURANCE AUDIT REPORT (cont.)

Brief Description of the Sampling and Analytical Requirements

Quality Assurance Deficiencies

FIGURE 11-2 (cont.)
QUALITY ASSURANCE AUDIT REPORT
QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

**ABB Environmental Services, Inc.**

## QUALITY ASSURANCE AUDIT REPORT (cont.)

Recommended Corrective Actions and Schedule

Signed Date

Title

Reviewed by Date

Title

Distribution:

FIGURE 11-2 (cont.)
QUALITY ASSURANCE AUDIT REPORT
QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

**ABB Environmental Services, Inc.**

## DOCUMENT REVIEW/RELEASE FORM

Document Title: ______________________________

______________________________

Client: ______________________ PN: __________ Document Type: __________

Date Submitted: ______________________ Due Date: ______________________

______________________________

| Title | Name | Initial Review (Initial) | See Revision (Y/N) | Release (Signature) | Date |
|---|---|---|---|---|---|
| Author | | | | | |
| Project Manager | | | | | |
| Task Leader | | | | | |
| Project Review Committee Representative | | | | | |
| Edit. Reviewer | | | | | |
| QA Reviewer | | | | | |
| Group Leader | | | | | |

**FIGURE 11-3**
**DELIVERABLE REVIEW RELEASE FORM**
**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

**ABB Environmental Services, Inc.**

## Table 2-1
## Unified Soil Classification System

## Quality Assurance Project Plan
## Fort Dix RI/FS MAG-1 Area

| Field Identification Procedures (Excluding particles larger than 3 in. and basing fractions on estimated weights) | | | | Group Symbols[a] | Typical Names | Information Required for Describing Soils |
|---|---|---|---|---|---|---|
| Coarse-grained soils more than half of material is larger than No. 200 sieve size[b] | Gravels more than half of coarse fraction is larger than No. 4 sieve size | Clean gravels (little or no fines) | Wide range in grain size and substantial amounts of all intermediate particle sizes | GW | Well graded gravels, gravel-sand mixtures, little or no fines | Give typical name; indicate approximate percentages of sand and gravel; maximum size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbols in parentheses.<br><br>For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics.<br><br>Example:<br>Silty sand, gravelly, about 20% hard, angular gravel particles ½-in. maximum size; rounded and subangular sand grains coarse to fine, about 15% nonplastic fines with low dry strength; well compacted and moist in place; alluvial sand; (SM) |
| | | | Predominantly one size or a range of sizes with some intermediate sizes missing | GP | Poorly graded gravels, gravel-sand mixtures, little or no fines | |
| | | Gravels with fines (appreciable amount of fines) | Nonplastic fines (for identification procedures, see ML below) | GM | Silty gravels, poorly graded gravel-sand-silt mixtures | |
| | | | Plastic fines (for identification procedures, see CL below) | GC | Clayey gravels, poorly graded gravel-sand-clay mixtures | |
| | Sands more than half of coarse fraction is smaller than No. 4 sieve size | Clean sands (little or no fines) | Wide range in grain sizes and substantial amounts of all intermediate sizes missing | SW | Well graded sands, gravelly sands, little or no fines | |
| | | | Predominantly one size or a range of sizes with some intermediate sizes missing | SP | Poorly graded sands, gravelly sands, little or no fines | |
| | | Sands with fines (appreciable amount of fines) | Nonplastic fines (for identification procedures, see ML below) | SM | Silty sands, poorly graded sand-silt mixtures | |
| | | | Plastic fines (for identification procedures, see CL below) | SC | Clayey sands, poorly graded sand-clay mixtures | |

**TABLE 2-1**
**UNIFIED SOIL CLASSIFICATION**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN NO. 40 SIEVE SIZE | | | | | GROUP SYMBOLS[a] | TYPICAL NAMES | INFORMATION REQUIRED FOR DESCRIBING SOILS |
|---|---|---|---|---|---|---|---|
| Fine-grained soils more than half of material is smaller than No. 200 sieve size | Silts and clays liquid limit less than 50 | DRY STRENGTH (CRUSHING CHARACTERISTICS) | DILATANCY (REACTION TO SHAKING) | TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT) | | | |
| | | None to slight | Quick to slow | None | ML | Inorganic silts and vary fine sands, rock flour, silty or clayey fine sands with slight plasticity | Give typical; indicate degree and character of plasticity, amount and maximum size of coarse grains; color in wet condition, odor if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses.<br><br>For undisturbed soils add information on structure, stratification, consistency in undisturbed and re-molded states, moisture and drainage conditions.<br><br>Example:<br>Clayey silt, brown; slightly plastic, small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; (ML) |
| | | Medium to high | None to very slow | Medium | CL | Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays | |
| | | Slight to medium | Slow | Slight | OL | Organic silts and organic silt-clays of low plasticity | |
| | Silts and clays liquids limit greater than 50 | Slight to medium | Slow to none | Slight to medium | MH | Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic soils | |
| | | High to very high | None | High | CH | Inorganic clays of high plasticity, fat clays | |
| | | Medium to high | None to very slow | Slight to medium | OH | Organic clays of medium to high plasticity | |
| HIGHLY ORGANIC SOILS | | Readily identified by color, odor, spongy feel and frequently by fibrous texture | | | Pt | Peat and other highly organic soils | |

**TABLE 2-2**
**SUMMARY OF CHEMICAL ANALYSES FOR GROUNDWATER SAMPLES**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| ANALYTE | METHOD[1] | NUMBER OF SAMPLES[5] | NUMBER OF QC SAMPLES[2] | |
|---|---|---|---|---|
| | | | DUPLICATES | RINSE BLANKS[3] |
| TCL VOCs | USAEC: UM20 (GC/MS) | 35 | 2 | 5 |
| VOC Screening[4] | Field GC | 100 | 10 | 10 |
| TCL SVOCs | USAEC: UM18 (GC/MS) | 23 | 2 | 5 |
| TAL Metals | USAEC: SS10 (ICAP);<br>SD09 (Thallium, GFAA);<br>SD20 (Lead, GFAA);<br>SD21 (Selenium, GFAA);<br>SD22 (Arsenic, GFAA);<br>SD23 (Silver, GFAA);<br>SD28 (Antimony, GFAA);<br>SB01 (Mercury, CVAA); | 23<br><br>1 | 2 | 5 |
| Inorganics | USAEC: TF27 (Phosphate)<br>TT10 (Sulfate)<br>TF22: (Nitrate)<br>USEPA: 353.2 (Nitrite) | 23 | 2 | 5 |
| Explosives | USAEC: UW32 (HPLC) | 33 | 2 | 5 |
| Explosives Screening[4] | Immunoassay Field Test Kit | 100 | 10 | 10 |
| TPH | USEPA: 418.1 | 2 | 0 | 0 |
| Pesticides/PCBs | USAEC; UH13 (pesticides, GC/ECD)<br>UH02 (PCBs, GC/ECD) | 1 | 0 | 0 |
| Oil & Grease | USEPA: 413.2 | 1 | 0 | 0 |
| TOC | USEPA: 415.1 | 1 | 0 | 0 |

**Notes:**

| | | |
|---|---|---|
| TCL VOCs | = | USEPA Target Compound List of Volatile Organic Compounds |
| TCL SVOCs | = | USEPA Target Compound List of Semivolatile Organic Compounds |
| TAL Metals | = | USEPA Target Analyte List of Metals |
| HPLC | = | High Pressure Liquid Chromatography |
| ICAP | = | Inductively Coupled Argon Plasma |
| CVAA | = | Cold Vapor Atomic Absorption |
| GFAA | = | Graphite Furnace Atomic Absorption |
| GC/MS | = | Gas Chromatography/Mass Spectrometry |
| GC/ECD | = | Gas Chromatography/Electron Capture Detector |

**Footnotes:**

1 Performance demonstrated methods from ESE Laboratory, Gainesville, Florida.

2 One trip blank (prepared by laboratory) will be sent with each cooler containing aqueous samples from monitoring wells for VOC analysis. Trip blanks will be analyzed for VOCs.

3 One rinse blank sample will be collected from decontaminated sampling equipment at a rate of one sample per equipment type per decontamination event with a maximum of one sample per day.

4 Up to ten groundwater field screening samples will be submitted for confirmatory analyses of VOCs and explosives.

5 Includes source water, septic tank and UST samples.

**TABLE 2-3**
**SUMMARY OF CHEMICAL ANALYSES FOR SURFACE WATER SAMPLES**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| ANALYTE | METHOD[1] | NUMBER OF SAMPLES | NUMBER OF QC SAMPLES[2] | |
|---|---|---|---|---|
| | | | DUPLICATES | RINSE BLANKS[3] |
| TCL VOCs | USAEC: UM20 (GC/MS) | 15 | 1 | 0 |
| TCL SVOCs | USAEC: UM18 (GC/MS) | 15 | 1 | 0 |
| TCL Pesticides/PCBs | USAEC: UH13 (Pesticides, GC/ECD); UH02 (PCBs, GC/ECD) | 15 | 1 | 0 |
| TAL Metals | USAEC: SS10 (ICAP); SD09 (Thallium, GFAA); SD20 (Selenium, GFAA); SD21 (Lead, GFAA); SD22 (Arsenic, GFAA); SD23 (Silver, GFAA); SD28 (Antimony, GFAA); SB01 (Mercury, CVAA); | 15 | 1 | 0 |
| Explosives | USAEC: UW32 (HPLC) | 15 | 1 | 0 |

**Notes:**

| | | |
|---|---|---|
| TCL VOCs | = | USEPA Target Compound List of Volatile Organic Compounds |
| TCL SVOCs | = | USEPA Target Compound List of Semivolatile Organic Compounds |
| TCL Pesticides/ PCBs | = | USEPA Target Compound List of pesticides and polychlorinated biphenyls |
| TAL Metals | = | USEPA Target analyte list |
| HPLC | = | High Pressure Liquid Chromatography |
| ICAP | = | Inductively Coupled Argon Plasma |
| CVAA | = | Cold Vapor Atomic Absorption |
| GFAA | = | Graphite Furnace Atomic Absorption |
| GC/MS | = | Gas Chromatography/Mass Spectrometry |

**Footnotes:**

1 Performance demonstrated methods from ESE Laboratory, Gainesville, Florida.

2 One trip blank (prepared by laboratory) will be sent with each cooler containing aqueous samples for VOC analysis. Trip blanks will be analyzed for VOCs.

3 Surface water samples will be collected directly into sample containers. Therefore, no rinse blank samples are necessary.

**TABLE 2-4**
**SUMMARY OF CHEMICAL ANALYSES FOR SEDIMENT SAMPLES**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| ANALYTE | METHOD[1] | NUMBER OF SAMPLES | NUMBER OF QC SAMPLES[2] | |
|---|---|---|---|---|
| | | | DUPLICATES | RINSE BLANKS[3] |
| TCL VOCs | USAEC: LM19 (GC/MS) | 15 | 1 | 1 |
| TCL SVOCs | USAEC: LM18 (GC/MS) | 15 | 1 | 1 |
| TCL Pesticides/PCBs | USAEC: LH10 (Pesticides, GC/EDC); LH16 (PCBs, GC/ECD) | 15 | 1 | 1 |
| TAL Metals | USAEC: JS16 (ICAP);<br>JD24 (Thallium, GFAA);<br>JD15 (Selenium, GFAA);<br>JD19 (Arsenic, GFAA);<br>JB01 (Mercury, CVAA);<br>JD17 (Lead, GFAA);<br>JD16 (Vanadium GFAA);<br>JD18 (Silver GFAA) | 15 | 1 | 1 |
| Explosives | USAEC: LW32 (HPLC) | 15 | 1 | 1 |
| TOC | USEPA: 415.1 | 15 | 1 | 1 |

**Notes:**

| | | |
|---|---|---|
| TCL VOCs | = | USEPA Target Compound List of Volatile Organic Compounds |
| TCL SVOCs | = | USEPA Target Compound List of Semivolatile Organic Compounds |
| TCL Pesticides/ PCBs | = | USEPA Target Compound List of pesticides and polychlorinated biphenyls |
| TAL Metals | = | USEPA Target analyte list |
| TOC | = | Total Organic Carbon |
| HPLC | = | High Pressure Liquid Chromatography |
| ICAP | = | Inductively Coupled Argon Plasma |
| CVAA | = | Cold Vapor Atomic Absorption |
| GFAA | = | Graphite Furnace Atomic Absorption |
| GC/MS | = | Gas Chromatography/Mass Spectrometry |

**Footnotes:**

1 Performance demonstrated methods from ESE Laboratory, Gainesville, Florida.

2 One trip blank (prepared by laboratory) will be sent with each cooler containing aqueous samples for VOC analysis. Trip blanks will be analyzed for VOCs.

3 One rinse blank sample will be collected from decontaminated sampling equipment at a rate of one sample per equipment type per decontamination event with a maximum of one sample per day.

## TABLE 2-5
## SUMMARY OF GEOTECHNICAL AND CHEMICAL ANALYSES FOR SOIL SAMPLES[1]

### QUALITY ASSURANCE PROJECT PLAN
### FORT DIX RI/FS MAG-1 AREA

| ANALYTE | METHOD[2] | NUMBER OF SAMPLES | NUMBER OF QC SAMPLES[3] | |
|---|---|---|---|---|
| | | | DUPLICATES | RINSE BLANKS[4] |
| TCL VOCs | USAEC: LM19 (GC/MS) | 47 | 3 | 10 |
| TCL SVOCs | USAEC: LM18 (GC/MS) | 39 | 3 | 10 |
| Explosives | USAEC: LW12 (HPLC) | 39 | 3 | 10 |
| TAL Metals | USAEC: JS16 (ICAP); JD24 (Thallium, GFAA); JD15 (Selenium, GFAA); JD19 (Arsenic, GFAA); JB01 (Mercury, CVAA); JD16 (Vanadium, GFAA); JD18 (Silver, GFAA) | 39 | 3 | 10 |
| Lead | USAEC: JD17 (Lead, GFAA) | 4 | 0 | 0 |
| Oil and Grease | USEPA: 413.2 | 39 | 3 | 10 |
| TPH | USEPA: 418.1 (IR) | 4 | 3 | 1 |
| TOC | USEPA: 9060 | 39 | 3 | 10 |
| GSA and Atterburg | ASTM D422, D2216, and D4318 | 18 | N/A | N/A |
| **WASTE CHARACTERIZATION** | | | | |
| TCL VOCs | USAEC: LM19 (GC/MS) | 13 | 0 | 0 |

**Notes:**

| | | |
|---|---|---|
| TCL VOCs | = | USEPA Target Compound List of Volatile Organic Compounds |
| TCL SVOCs | = | USEPA Target Compound List of Semivolatile Organic Compounds |
| TAL Metals | = | USEPA Target analyte list |
| ICAP | = | Inductively Coupled Argon Plasma |
| CVAA | = | Cold Vapor Atomic Absorption |
| GFAA | = | Graphite Furnace Atomic Absorption |
| GC/MS | = | Gas Chromatography/Mass Spectrometry |
| GC/ECD | = | Gas Chromatography/Electron Capture Detector |
| GSA | = | Grain Size Analysis |
| HPLC | = | High Pressure Liquid Chromatography |
| IR | = | Infrared Spectrophotometry |
| N/A | = | Not Applicable |
| TPH | = | Total Recoverable Petroleum Hydrocarbons |
| TOC | = | Total Organic Carbon |

**Footnotes:**

1 Includes test pits, soil borings, and investigation derived waste samples.

2 Performance demonstrated methods from ESE Laboratory, Gainesville, Florida.

3 One trip blank (prepared by laboratory) will be sent with each cooler containing aqueous samples for VOC analysis. Trip blanks will be analyzed for VOCs.

4 One rinse blank sample will be collected from decontaminated sampling equipment at a rate of one sample per equipment type per decontamination event with a maximum of one sample per day.

**TABLE 2-6**
**SUMMARY OF SOIL SAMPLES TO BE COLLECTED FOR PHYSICAL ANALYSES**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| PHYSICAL CHARACTERISTICS | METHOD | NUMBER OF SAMPLES |
|---|---|---|
| Atterberg Limits | ASTM D-4318[1] | 8 |
| Grain Size | ASTM D-422[2] | 18 |
| USCS | ASTM D-8247[3] | 18 |

**Footnotes:**

1 ASTM, 1991c
2 ASTM, 1991a
3 ASTM, 1991b

**TABLE 4-1**
**LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TCL ANALYTES IN GROUNDWATER MAG-1 AREA CONTAMINANTS BOLDED[j]**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| TCL ANALYTE | USAEC GROUNDWATER CRL (µg/L) | USAEC GROUNDWATER COD (µg/L) | USAEC CERTIFIED GROUNDWATER METHOD NUMBER[A] | GROUNDWATER LOC (µg/L) |
|---|---|---|---|---|
| Acenaphthene | 1.7 | 0.85 | UM 18 | 10.0 |
| Acenaphthylene | 0.5 | 0.25 | UM 18 | 10.0 |
| Acetone | 13 | 6.5 | UM 20 | -- |
| Anthracene | 0.5 | 0.25 | UM 18 | 10.0 |
| **Benzene** | **0.5** | **0.25** | **UM 20** | **1.0** |
| Benzo(a)anthracene | 1.6 | 0.80 | UM 18 | 10.0 |
| Benzo(b)fluoranthene | 5.4 | 2.7 | UM 18 | 10.0 |
| Benzo(k)fluoranthene | 0.87 | 0.435 | UM 18 | 2.0 |
| Benzo(ghi)perylene | 0.61 | 0.305 | UM 18 | 20.0 |
| Benzo(a)pyrene | 4.7 | 2.35 | UM 18 | 20.0 |
| Benzyl alcohol | 0.72 | 0.36 | UM 18 | -- |
| Benzylbutylphthalate | 3.4 | 1.7 | UM 18 | 100.[c] |
| Bis(2-chloroethoxy)-methane | 1.5 | 0.75 | UM 18 | -- |
| Bis(2-chloroethyl)ether | 1.9 | 0.95 | UM 18 | 10.0 |
| Bis(2-chloroisopropyl)ether | 5.3 | 2.65 | UM 18 | 10.0 |
| Bis(2-ethylhexyl) phthalate | 4.8 | 2.4 | UM 18 | 30.0 |
| Bromodichloromethane | 0.59 | 0.295 | UM 20 | 1.0 |
| Bromoform[g] | 2.6 | 1.3 | UM 20 | 0.8 |
| Bromomethane | 5.8 | 2.9 | UM 20 | 10.0[d] |
| 4-Bromophenyl-phenylether | 4.2 | 2.1 | UM 18 | -- |
| 2-Butanone | 6.4 | 3.2 | UM 20 | -- |
| Carbon disulfide | 0.5 | 0.25 | UM 20 | -- |
| Carbon tetrachloride | 0.58 | 0.29 | UM 20 | 2.0 |
| 4-Chloroaniline | 7.3 | 3.65 | UM 18 | -- |
| Chlorobenzene | 0.5 | 0.25 | UM 20 | 2.0 |
| Chloroethane | 1.9 | 0.95 | UM 20 | -- |
| **Chloroform** | **0.5** | **0.25** | **UM 20** | **1.0** |

TABLE 4-1
LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS
FOR TCL ANALYTES IN GROUNDWATER
MAG-1 AREA CONTAMINANTS BOLDED[j]

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

| TCL ANALYTE | USAEC GROUNDWATER | | USAEC CERTIFIED GROUNDWATER METHOD NUMBER[A] | GROUNDWATER LOC (μg/L) |
|---|---|---|---|---|
| | CRL (μg/L) | COD (μg/L) | | |
| Chloromethane | 3.2 | 1.6 | UM 20 | 3.0[d] |
| 2-Chloronapthalene | 0.5 | 0.25 | UM 18 | -- |
| 4-Chloro-3-methylphenol | 4.0 | 2.0 | UM 18 | -- |
| 2-Chlorophenol | 0.99 | 0.495 | UM 18 | 20.0 |
| 4-Chlorophenyl-phenylether | 5.1 | 2.55 | UM 18 | -- |
| Chrysene | 2.4 | 1.2 | UM 18 | 20.0 |
| Dibenzo(a,h)anthracene | 6.5 | 3.25 | UM 18 | 20.0 |
| Dibenzofuran | 1.7 | 0.85 | UM 18 | -- |
| Dibromochloromethane | 0.67 | 0.335 | UM 20 | 1.0 |
| Di-n-butylphthalate | 3.7 | 1.85 | UM 18 | 20.0 |
| 1,2-Dichlorobenzene | 1.7 | 0.85 | UM 18 | 5.0 |
| 1,3-Dichlorobenzene | 1.7 | 0.85 | UM 18 | 5.0 |
| 1,4-Dichlorobenzene | 1.7 | 0.85 | UM 18 | 5.0 |
| 3,3-Dichlorobenzidine | 12 | 6.0 | UM 18 | 60.0 |
| 1,1-Dichloroethane | 0.68 | 0.34 | UM 20 | -- |
| 1,2-Dichloroethane | 0.50 | 0.25 | UM 20 | 2.0 |
| **1,1-Dichloroethene** | **0.50** | **0.25** | **UM 20** | **2.0** |
| **1,2-Dichloroethene** | **0.50** | **0.25** | **UM 20** | **2.0** |
| Dichloromethane | 2.3 | 1.15 | UM 20 | 5.0[c] |
| cis-1,3-Dichloropropene | 0.58 | 0.29 | UM 20 | 5.0 |
| trans-1,3-Dichloropropene | 0.70 | 0.35 | UM 20 | 7.0 |
| 1,2-Dichloropropane | 0.50 | 0.25 | UM 20 | 1.0 |
| Diethylphthalate | 2.0 | 1.0 | UM 18 | 10.0 |
| Dimethylphthalate | 1.5 | 0.75 | UM 18 | 10.0 |
| 2,4-Dinitrotoluene | 4.5 | 2.25 | UM 18 | 10.0 |
| 2,6-Dinitrotoluene | 0.79 | 0.395 | UM 18 | 10.0 |
| Di-n-octyl phthalate | 15.0 | 7.5 | UM 18 | -- |
| **Ethylbenzene** | **0.5** | **0.25** | **UM 20** | **5.0** |
| Fluoranthene | 3.3 | 1.65 | UM 18 | 10.0 |

# TABLE 4-1
## LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TCL ANALYTES IN GROUNDWATER MAG-1 AREA CONTAMINANTS BOLDED[j]

## QUALITY ASSURANCE PROJECT PLAN FORT DIX RI/FS MAG-1 AREA

| TCL ANALYTE | USAEC GROUNDWATER | | USAEC CERTIFIED GROUNDWATER METHOD NUMBER[A] | GROUNDWATER LOC ($\mu$g/L) |
|---|---|---|---|---|
| | CRL ($\mu$g/L) | COD ($\mu$g/L) | | |
| Fluorene | 3.7 | 1.85 | UM 18 | 10.0 |
| Hexachlorobenzene | 1.6 | 0.8 | UM 18 | 10.0 |
| Hexachlorobutadiene[g] | 3.4 | 1.7 | UM 18 | 1.0 |
| Hexachlorocyclo-pentadiene | 8.6 | 4.3 | UM 18 | 10.0 |
| Hexachloroethane | 1.5 | 0.75 | UM 18 | 10.0 |
| Indeno(1,2,3-cd)pyrene | 8.6 | 4.3 | UM 18 | 20.0 |
| Isophorone | 4.8 | 2.4 | UM 18 | 10.0 |
| 2-Methylnaphthalene | 1.7 | 0.85 | UM 18 | -- |
| 4-Methyl-2-pentanone | 3.0 | 1.5 | UM 20 | -- |
| Naphthalene | 0.5 | 0.25 | UM 18 | 20.0[d] |
| 2-Nitroaniline | 4.3 | 2.15 | UM 18 | -- |
| 3-Nitroaniline | 4.9 | 2.45 | UM 18 | -- |
| 4-Nitroaniline | 5.2 | 2.6 | UM 18 | -- |
| Nitrobenzene | 0.5 | 0.25 | UM 18 | 10.0 |
| N-Nitroso-di-n-propylamine | 4.4 | 2.2 | UM 18 | 20.0 |
| N-Nitrosodiphenylamine | 3.0 | 1.5 | UM 18 | 20.0 |
| Pentachlorophenol[h] | 18.0 | 9.0 | UM 18 | 1.0 |
| Phenanthrene | 0.5 | 0.25 | UM 18 | 10.0 |
| Phenol | 9.2 | 4.6 | UM 18 | 10.0 |
| Pyrene | 2.8 | 1.4 | UM 18 | 20.0 |
| **Styrene** | **0.5** | **0.25** | **UM 20** | **5.0** |
| Tetrachloroethylene[i] | 1.6 | 0.8 | UM 20 | 1.0 |
| 1,1,2,2-Tetrachloroethane | 0.51 | 0.255 | UM 20 | 1.0 |
| Toluene | 0.5 | 0.25 | UM 20 | 5.0 |
| 1,2,4-Trichlorobenzene[i] | 1.8 | 0.9 | UM 18 | 1.0 |
| 1,1,1-Trichloroethane | 0.5 | 0.25 | UM 20 | 1.0 |
| 1,1,2-Trichloroethane | 1.2 | 0.6 | UM 20 | 2.0 |
| **Trichloroethene** | **0.5** | **0.25** | **UM 20** | **1.0** |

# TABLE 4-1
## LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TCL ANALYTES IN GROUNDWATER MAG-1 AREA CONTAMINANTS BOLDED[j]

## QUALITY ASSURANCE PROJECT PLAN FORT DIX RI/FS MAG-1 AREA

| TCL ANALYTE | USAEC GROUNDWATER CRL (μg/L) | USAEC GROUNDWATER COD (μg/L) | USAEC CERTIFIED GROUNDWATER METHOD NUMBER[A] | GROUNDWATER LOC (μg/L) |
|---|---|---|---|---|
| 2,4,5-Trichlorophenol | 5.2 | 2.6 | UM 18 | 10.0 |
| 2,4,6-Trichlorophenol | 4.2 | 2.1 | UM 18 | 20.0 |
| Vinyl acetate | 8.3 | 4.15 | UM 20 | -- |
| Vinyl chloride | 2.6 | 1.3 | UM 20 | 5.0 |
| **Total xylenes** | **0.84** | **0.42** | **UM 20** | **2.0** |

**Notes:**

PMRD  Prescribed Procedures for Measurement of Radioactivity in Drinking Water, Environmental Monitoring and Support Laboratory, EPA-600/4-80-032, August 1990.
SW-846  Test Methods for Evaluating Solid Waste, USEPA SW-846, Third Edition, September 1986 with all current revisions.
CRL  Certified Reporting Limit
COD  Criteria of Detection, extended detection limits = 0.5 * CRL
LOC  Level of Concern. Defined as the NJDEPE GW-1 PQL, unless otherwise noted. Groundwater Quality Standards (NJDEPE 1993) N.J.A.C. 7:9-6.
PQL  Practical Quantitation Limits. This is an estimated value, which is dependent on the sample matrix and the instrumentation.
MDL  Method Detection Limit
NTAM  Entered into the USAEC IRDMIS database as a non-performance demonstrated method.
GFPC  Gas Flow Proportional Counter
Ge(Li)  Lithium Drifted Germanium Detector
—  No guideline or standard available.
(a)  USAEC performance demonstrated methods used unless the CRL or COD cannot achieve the LOC. Non-USAEC methods referenced with CRQLs or method detection limits in these select cases.
(b)  Data are reported for the total concentration of all detected polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans. However, because the number of non-2,3,7,8-substituted isomers that might be detected in a sample is unpredictable, it is not possible to assign CRQL values to the total homologue concentrations.
(c)  Environmental Protection Agency (EPA). Maximum Contaminant Level (MCL). Drinking Water Regulations and Health Advisories, Washington, D.C., November 1992.
(d)  Environmental Protection Agency (EPA). Drinking Water Health Advisory for Lifetime Exposure. Drinking Water Regulations and Health Advisories, Washington, D.C., November 1992.
(e)  The analysis of the Aroclors is certified by the first and last Aroclor, 1016 and 1260, respectively. In addition, if the associated spikes and duplicates are in control for Aroclor 1016 and Aroclor 1260, as required by the certified method, the the analysis for Aroclors is considered to be in control.
(f)  The detection limits for these analytes are non-certifed.
(g)  Both the CRL and the COD are slightly greater than the Level of Concern (LOC).
(h)  In order to meet the LOC, USEPA methodology will be used.
(i)  Although the CRL is greater than the LOC, the COD is less than the LOC. The COD will be reported to the USAEC data base when the analyte is not detected.
(j)  MAG-1 Area contaminants identified from Dames and Moore 1993 Phase II RI.

**Source:** ICF-KE, 1993

**TABLE 4-2**
**LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TAL METALS IN GROUNDWATER**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| ANALYTE | USAEC GROUNDWATER CRL µg/L | USAEC GROUNDWATER COD µg/L | USAEC CERTIFIED GROUNDWATER METHOD NUMBER | GROUNDWATER LOC µg/L |
|---|---|---|---|---|
| Aluminum | 141. | 70.5 | SS10 | 200. |
| Antimony | 3.02 | 1.52 | SD28 | 20.0 |
| Arsenic | 2.54 | 1.27 | SD22 | 8.0 |
| Barium | 5.0 | 2.5 | SS10 | 200. |
| Beryllium | 5.0 | 2.5 | SS10 | 20.0 |
| Cadmium[b] | 4.01 | 2.0 | SS10 | 2.0 |
| Chromium | 6.02 | 3.0 | SS10 | 10.0 |
| Copper | 8.1 | 4.05 | SS10 | 1000. |
| Iron | 38.8 | 19.4 | SS10 | 100. |
| Lead | 1.26 | 0.63 | SD21 | 10.0 |
| Manganese | 2.75 | 1.375 | SS10 | 6.0 |
| Mercury | 0.243 | 0.122 | SB01 | 0.5 |
| Nickel | 7.11 | 3.56 | SS18 | 10.0 |
| Selenium | 3.02 | 1.51 | SD20 | 10.0 |
| Silver | 0.25 | 0.125 | SD23 | 2.0 |
| Sodium[b] | 500 | 250 | SS10 | 400. |
| Thallium | 6.99 | 3.50 | SD09 | 10.0 |
| Vanadium | 11.0 | 5.5 | SS10 | 20.0[a] |
| Zinc | 21.1 | 10.55 | SS10 | 30.0 |

**Notes:**

– = No guidelines or standards available.
CRL = Certified Reporting Limit
COD = Criteria of Detection, extended detection limits = 0.5 * CRL
LOC = Level of Concern. Defined as the GW-1 PQL, unless otherwise noted. Groundwater Quality Standards (NJDEPE 1993) N.J.A.C. 7:9-6. For inorganics, the "natural background" concentrations will also be considered as LOCs. "Natural inorganic background" will be established from analytical results from background samples and published regional background data.
PQL = Practical Quantitation Limits. This is an estimated value, which is dependent upon the sample matrix and instrumentation.
— = No guideline or standard available.
(a) Environmental Protection Agency (EPA). Drinking Water Health Advisory for Lifetime Exposure. Drinking Water Regulations and Health Advisories, Washington, D.C., November 1992.
(b) Although the CRL is greater than the LOC, the COD is less than the LOC. The COD will be reported to the USAEC data base when the analyte is not detected.
(c) Both the CRL and the COD are greater than the LOC.

**TABLE 4-3**
**LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TCL ANALYTES IN SOILS**
**MAG-1 AREA CONTAINANTS BOLDED[a]**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| TCL ANALYTE | USAEC SOIL CRL (mg/kg) | USAEC SOIL COD (mg/kg) | USAEC CERTIFIED SOIL METHOD NUMBER | Soil LOC (mg/kg) |
|---|---|---|---|---|
| Acenaphthene | 0.036 | 0.018 | LM 18 | 100. |
| Acenaphthylene | 0.033 | 0.0165 | LM 18 | -- |
| **Acetone** | **0.017** | **0.0085** | **LM 19** | **50.** |
| Aldrin | 0.00729 | 0.00364 | LH 10 | 0.17 |
| Anthracene | 0.033 | 0.0165 | LM 18 | 500. |
| **Benzene** | **0.0015** | **0.00075** | **LM 19** | **1.0** |
| Benzo(a)anthracene | 0.17 | 0.085 | LM 18 | 4.0 |
| Benzo(b)fluoranthene | 0.21 | 0.105 | LM 18 | 4.0 |
| Benzo(k)fluoranthene | 0.066 | 0.033 | LM 18 | 4.0 |
| Benzo(ghi)perylene | 0.25 | 0.125 | LM 18 | -- |
| Benzo(a)pyrene | 0.25 | 0.125 | LM 18 | 0.66 |
| Benzyl alcohol | 0.19 | 0.095 | LM 18 | 50.0 |
| Benzylbutylphthalate | 0.17 | 0.085 | LM 18 | 100. |
| gamma BHC (lindane) | 0.00638 | 0.0032 | LH 10 | 1.0 |
| Bis(2-chloroethoxy)-methane | 0.059 | 0.030 | LM 18 | -- |
| Bis(2-chloroethyl)ether | 0.033 | 0.016 | LM 18 | 1.0 |
| Bis(2-chloroisopropyl)ether | 0.2 | 0.10 | LM 18 | 10.0 |
| Bis(2-ethylhexyl) phthalate | 0.62 | 0.31 | LM 18 | 100. |
| Bromodichloromethane | 0.0029 | 0.0014 | LM 19 | 1.0 |
| Bromoform | 0.0069 | 0.0034 | LM 19 | 1.0 |
| Bromomethane | 0.0057 | 0.0028 | LM 19 | 1.0 |
| 4-Bromophenyl-phenylether | 0.033 | 0.016 | LM 18 | -- |
| 2-Butanone | 0.07 | 0.035 | LM 19 | 50.0 |
| Carbon disulfide | 0.0044 | 0.0022 | LM 19 | -- |
| Carbon tetrachloride | 0.007 | 0.0035 | LM 19 | 1.0 |
| Chlordane | 0.0177 | 0.0088 | LH 10 | -- |
| 4-Chloroaniline | 0.81 | 0.405 | LM 18 | 4200. |

**TABLE 4-3**
**LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TCL ANALYTES IN SOILS**
**MAG-1 AREA CONTAMINANTS BOLDED[e]**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| TCL ANALYTE | USAEC SOIL CRL (mg/kg) | USAEC SOIL COD (mg/kg) | USAEC CERTIFIED SOIL METHOD NUMBER | Soil LOC (mg/kg) |
|---|---|---|---|---|
| Chlorobenzene | 0.00086 | 0.00043 | LM 19 | 1.0 |
| Chloroethane | 0.012 | 0.006 | LM 19 | -- |
| Chloroform | 0.00087 | 0.00043 | LM 19 | 1.0 |
| Chloromethane | 0.0088 | 0.0044 | LM 19 | 10.0 |
| 2-Chloronapthalene | 0.036 | 0.018 | LM 18 | -- |
| 4-Chloro-3-methylphenol | 0.095 | 0.0475 | LM 18 | 100. |
| 2-Chlorophenol | 0.06 | 0.03 | LM 18 | 50.0 |
| 4-Chlorophenyl-phenylether | 0.033 | 0.0165 | LM 18 | -- |
| Chrysene | 0.12 | 0.06 | LM 18 | 40.0 |
| 4,4'-DDD | 0.00826 | 0.00413 | LH 10 | 12.0 |
| 4,4'-DDE | 0.00765 | 0.00038 | LH 10 | 9.0 |
| 4,4'-DDT | 0.00707 | 0.00035 | LH 10 | 9.0 |
| Dibenzo(a,h)anthracene | 0.21 | 0.105 | LM 18 | 0.66 |
| Dibenzofuran | 0.035 | 0.0175 | LM 18 | -- |
| Dibromochloromethane | 0.0031 | 0.00155 | LM 19 | 1.0 |
| Di-n-butylphthalate | 0.061 | 0.0305 | LM 18 | 100. |
| 1,2-Dichlorobenzene | 0.11 | 0.055 | LM 18 | 50.0 |
| 1,3-Dichlorobenzene | 0.13 | 0.065 | LM 18 | 100. |
| 1,4-Dichlorobenzene | 0.098 | 0.049 | LM 18 | 100. |
| 3,3-Dichlorobenzidine[a] | 6.3 | 3.15 | LM 18 | 6.0 |
| 1,1-Dichloroethane | 0.0023 | 0.0012 | LM 19 | 1.0 |
| 1,2-Dichloroethane | 0.0017 | 0.0008 | LM 19 | 1.0 |
| 1,1-Dichloroethene | 0.0039 | 0.0020 | LM 19 | 10.0 |
| **1,2-Dichloroethene** | **0.003** | **0.0015** | **LM 19** | **50.0** |
| Dichloromethane | 0.012 | 0.006 | LM 19 | -- |
| cis-1,3-Dichloropropene | 0.0032 | 0.0016 | LM 19 | 1.0 |
| trans-1,3-Dichloropropene | 0.0028 | 0.0014 | LM 19 | 1.0 |
| 1,2-Dichloropropane | 0.0029 | 0.0014 | LM 19 | 43.0 |

**TABLE 4-3**
**LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TCL ANALYTES IN SOILS**
**MAG-1 AREA CONTAMINANTS BOLDED[a]**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| TCL ANALYTE | USAEC SOIL | | USAEC CERTIFIED SOIL METHOD NUMBER | Soil LOC (mg/kg) |
|---|---|---|---|---|
| | CRL (mg/kg) | COD (mg/kg) | | |
| Dieldrin | 0.00629 | 0.00314 | LH 10 | 0.18 |
| Diethylphthalate | 0.24 | 0.12 | LM 18 | 50.0 |
| Dimethylphthalate | 0.17 | 0.085 | LM 18 | 50.0 |
| 2,4-Dinitrotoluene | 0.14 | 0.07 | LM 18 | -- |
| 2,6-Dinitrotoluene | 0.085 | 0.0425 | LM 18 | -- |
| Di-n-octyl phthalate | 0.19 | 0.095 | LM 18 | 100. |
| Endrin | 0.00657 | 0.0033 | LH 10 | 50.0 |
| **Ethylbenzene** | **0.0017** | **0.0085** | **LM 19** | **100.** |
| Fluoranthene | 0.068 | 0.034 | LM 18 | 500. |
| Fluorene | 0.033 | 0.0165 | LM 18 | 100. |
| Heptachlor | 0.00618 | 0.0031 | LH 10 | 0.65 |
| Heptachlor epoxide | 0.0062 | 0.0031 | LH 10 | -- |
| Hexachlorobenzene | 0.033 | 0.0165 | LM 18 | 2.0 |
| Hexachlorobutadiene | 0.23 | 0.115 | LM 18 | 50.0 |
| Hexachlorocyclo-pentadiene | 6.2 | 3.1 | LM 18 | 100. |
| Hexachloroethane | 0.15 | 0.075 | LM 18 | 100. |
| Indeno(1,2,3-cd)pyrene | 0.29 | 0.145 | LM 18 | 4.0 |
| Isophorone | 0.033 | 0.0165 | LM 10 | 10.0 |
| Methoxychlor | 0.0711 | 0.0356 | LH 10 | 500. |
| 2-Methylnaphthalene | 0.049 | 0.0245 | LM 18 | -- |
| 4-Methyl-2-pentanone | 0.027 | 0.0135 | LM 19 | 50.0 |
| Naphthalene | 0.037 | 0.0185 | LM 18 | 100. |
| 2-Nitroaniline | 0.062 | 0.31 | LM 18 | -- |
| 3-Nitroaniline | 0.45 | 0.225 | LM 18 | -- |
| 4-Nitroaniline | 0.41 | 0.205 | LM 18 | -- |
| Nitrobenzene | 0.045 | 0.225 | LM 18 | 50.0 |
| N-Nitroso-di-n-propylamine | 0.2 | 0.1 | LM 18 | 1.0 |

**TABLE 4-3**
**LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TCL ANALYTES IN SOILS**
**MAG-1 AREA CONTAMINANTS BOLDED[a]**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| TCL ANALYTE | USAEC SOIL CRL (mg/kg) | USAEC SOIL COD (mg/kg) | USAEC CERTIFIED SOIL METHOD NUMBER | Soil LOC (mg/kg) |
|---|---|---|---|---|
| N-Nitrosodiphenylamine | 0.19 | 0.095 | LM 18 | 100. |
| PCBs[b]: | | | | 2.0 |
| Aroclor 1016 | 0.0666 | 0.0333 | LH 16 | |
| Aroclor 1221[c] | 0.0666 | 0.0333 | LH 16 | |
| Aroclor 1232[c] | 0.0666 | 0.0333 | LH 16 | |
| Aroclor 1242[c] | 0.0804 | 0.0402 | LH 16 | |
| Aroclor 1248[c] | 0.0804 | 0.0402 | LH 16 | |
| Aroclor 1254[c] | 0.0804 | 0.0402 | LH 16 | |
| Aroclor 1260 | 0.0804 | 0.0402 | LH 16 | |
| Pentachlorophenol | 1.3 | 0.65 | LM 18 | 24.0 |
| Phenanthrene | 0.033 | 0.0165 | LM 18 | -- |
| Phenol | 0.11 | 0.055 | LM 18 | 50 |
| Pyrene | 0.033 | 0.0165 | LM 18 | 500. |
| Styrene | 0.0026 | 0.0013 | LM 19 | 97.0 |
| **Tetrachloroethylene** | **0.00081** | **0.00040** | **LM 19** | **1.0** |
| 1,1,2,2-Tetrachloroethane | 0.0024 | 0.0012 | LM 19 | 1.0 |
| **Toluene** | **0.00078** | **0.00039** | **LM 19** | **500.** |
| Toxaphene[d] | 0.444 | 0.222 | LH 10 | 0.20 |
| 1,2,4-Trichlorobenzene | 0.04 | 0.02 | LM 18 | 100. |
| **1,1,1-Trichloroethane** | **0.0044** | **0.0022** | **LM 19** | **50.0** |
| 1,1,2-Trichloroethane | 0.0054 | 0.0027 | LM 19 | 1.0 |
| **Trichloroethene** | **0.0028** | **0.0014** | **LM 19** | **1.0** |
| 2,4,5-Trichlorophenol | 0.10 | 0.05 | LM 18 | 50.0 |
| 2,4,6-Trichlorophenol | 0.17 | 0.085 | LM 18 | 50.0 |
| Vinyl acetate | 0.0032 | 0.016 | LM 19 | -- |
| Vinyl chloride | 0.0062 | 0.0031 | LM 19 | 1.0 |

**TABLE 4-3**
**LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS**
**FOR TCL ANALYTES IN SOILS**
**MAG-1 AREA CONTAMINANTS BOLDED[e]**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| TCL ANALYTE | USAEC SOIL CRL (mg/kg) | USAEC SOIL COD (mg/kg) | USAEC CERTIFIED SOIL METHOD NUMBER | Soil LOC (mg/kg) |
|---|---|---|---|---|
| Total xylenes | 0.0015 | 0.00075 | LM 19 | 10.0 |

**Notes:**

CRL Certified Reporting Limit
COD Criteria of Detection, extended detection limits = 0.5 * CRL
LOC Level of Concern. Based on the lower concentration between Non-residential soil cleanup criteria and Impact to Groundwater soil cleanup criteria. Proposed cleanup standards for contaminated sites (NJDEPE 1992). NJAC 7:26 D. Residential and Non-residential soil levels.
— No guideline or standard available.
(a) Although the CRL is greater than the LOC, the COD is less than the LOC. The COD will be reported to the USAEC data base when the analyte is not detected.
(b) The analysis of the Aroclors is certified by the first and last Aroclor, 1016 and 1260, respectively. In addition, if the associated spikes and duplicates are in control for Aroclor 1016 and Aroclor 1260, as required by the certified method, the analysis for Aroclors is considered to be in control.
(c) The detection limits for these analytes are non-certified.
(d) Both the CRL and COD are slightly greater than the LOC. The COD will be reported to the USAEC data base when the analyte is not detected.
(e) MAG-1 Area contaminants identified from Dames and Moore 1993 Phase II RI.

**TABLE 4-4**
**LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TAL METALS AND TPH IN SOILS**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| ANALYTE | USAEC SOIL | | USAEC CERTIFIED SOIL METHOD NUMBER | SOIL LOC mg/kg |
|---|---|---|---|---|
| | CRL mg/kg | COD mg/kg | | |
| **TAL Analytes** | | | | |
| Aluminum | 2.35 | 1.18 | JS16 | -- |
| Antimony | 7.14 | 3.57 | JS16 | 340 |
| Arsenic | 0.250 | 0.125 | JD19 | 2.0 |
| Barium | 5.18 | 2.59 | JS16 | 47,000 |
| Beryllium[a] | 0.5 | 0.25 | JS16 | 1.0 |
| Cadmium | 0.7 | 0.35 | JS16 | 100 |
| Chromium | 4.05 | 2.03 | JS16 | -- |
| Copper | 0.965 | 0.48 | JS16 | 600 |
| Iron | 3.68 | 1.84 | JS16 | -- |
| Lead | 10.5 | 5.25 | JS16 | 600 |
| Manganese | 2.05 | 1.03 | JS16 | -- |
| Mercury | 0.05 | 0.025 | JB01 | 270 |
| Nickel | 1.71 | 0.855 | JS16 | 2400 |
| Selenium | 0.25 | 0.125 | JD15 | 3100 |
| Silver | 0.589 | 0.295 | JS16 | 4100 |
| Sodium | 100.0 | 50.0 | JS16 | -- |
| Thallium | 0.50 | 0.25 | JD24 | 2.0 |
| Vanadium | 3.39 | 1.70 | JS16 | 7100 |
| Zinc | 8.03 | 4.02 | JS16 | 1500 |

**TABLE 4-4**
**LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TAL METALS AND TPH IN SOILS**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| ANALYTE | USAEC SOIL | | USAEC CERTIFIED SOIL METHOD NUMBER | SOIL LOC mg/kg |
|---|---|---|---|---|
| | CRL mg/kg | COD mg/kg | | |
| **Other Analytes Non-USAEC Methodology** | | | | |
| Total Petroleum Hydrocarbons (TPH) | PQL 30 | N/A | NTAM EPA CE/81-1 MCAWW 418.1 | — |

**Notes:**

| | |
|---|---|
| EPA CE/81-1 | "EPA/Army Corps of Engineers Oil and Grease Procedures for Sediment Samples" |
| MCAWW | Methods for Chemical Analysis of Water and Wastewater, MCAWW EPA-600/4-79-020, March 1983. |
| SW-846 | Test Methods for Evaluating Solid Waste, USEPA SW-846, Third Edition, September 1986 with all current revisions. |
| CRL | Certified Reporting Limit |
| COD | Criteria of Detection, extended detection limits = 0.5 * CRL |
| PQL | Practical Quantitation Limit. This is an estimated value, which is dependent upon the sample matrix and instrumentation. |
| NTAM | Entered into the USAEC IRDMIS database as a non-performance demonstrated method. |
| LOC | Level of Concern. Based on the lower concentration between Non-residential soil cleanup criteria and Impact to Groundwater soil cleanup criteria. For inorganics the "natural background" concentrations will be established from analytical results from background samples and published regional background data. Proposed Cleanup Standards for Contaminated Sites (NJDEPE 1992) NJAC 7:26 D. Residential and Non-residential soil levels. |
| — | No guideline or standard available. |
| (a) | Although the CRL is greater than the LOC, the COD is less than the LOC. |

- TABLE 4-5
LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS
FOR TCL ANALYTES IN SURFACE WATER
MAG-1 AREA CONTAMINANTS BOLDED[g]

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

| TCL ANALYTE | USAEC SURFACE WATER | | USAEC CERTIFIED SURFACE WATER METHOD NUMBER | SURFACE WATER LOC (µg/L) |
|---|---|---|---|---|
| | CRL (µg/L) | COD (µg/L) | | |
| Acenaphthene | 1.7 | 0.85 | UM 18 | 10.0 |
| Acenaphthylene | 0.5 | 0.25 | UM 18 | 10.0 |
| Acetone | 13 | 6.5 | UM 20 | -- |
| Aldrin[c] | 0.092 | 0.046 | UH 13 | 0.04 |
| Anthracene | 0.5 | 0.25 | UM 18 | 10.0 |
| Benzene | 0.5 | 0.25 | UM 20 | 7.0 |
| Benzo(a)anthracene | 1.6 | 0.80 | UM 18 | 10.0 |
| Benzo(b)fluoranthene | 5.4 | 2.7 | UM 18 | 10.0 |
| Benzo(k)fluoranthene | 0.87 | 0.435 | UM 18 | 20.0 |
| Benzo(ghi)perylene | 0.61 | 0.305 | UM 18 | 20.0 |
| Benzo(a)pyrene | 4.7 | 2.35 | UM 18 | 20.0 |
| Benzyl alcohol | 0.72 | 0.36 | UM 18 | -- |
| Benzylbutylphthalate | 3.4 | 1.7 | UM 18 | 20.0 |
| gamma BHC (lindane)[d] | 0.051 | 0.0255 | UH 13 | 0.03 |
| Bis(2-chloroethoxy)-methane | 1.5 | 0.75 | UM 18 | -- |
| Bis(2-chloroethyl)ether | 1.9 | 0.95 | UM 18 | 10.0 |
| Bis(2-chloroisopropyl)ether | 5.3 | 2.65 | UM 18 | 10.0 |
| Bis(2-ethylhexyl) phthalate | 4.8 | 2.4 | UM 18 | 30.0 |
| Bromodichloromethane | 0.59 | 0.295 | UM 20 | 5.0 |
| Bromoform | 2.6 | 1.3 | UM 20 | 8.0 |
| Bromomethane | 5.8 | 2.9 | UM 20 | 9.0 |
| 4-Bromophenyl-phenylether | 4.2 | 2.1 | UM 18 | -- |
| 2-Butanone | 6.4 | 3.2 | UM 20 | -- |
| Carbon disulfide | 0.5 | 0.25 | UM 20 | -- |

TABLE 4-5
LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS
FOR TCL ANALYTES IN SURFACE WATER
MAG-1 AREA CONTAMINANTS BOLDED[g]

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

| TCL ANALYTE | USAEC SURFACE WATER | | USAEC CERTIFIED SURFACE WATER METHOD NUMBER | SURFACE WATER LOC (µg/L) |
|---|---|---|---|---|
| | CRL (µg/L) | COD (µg/L) | | |
| Carbon tetrachloride | 0.58 | 0.29 | UM 20 | 6.0 |
| Chlordane[d] | 0.246 | 0.123 | UH 13 | 0.2 |
| 4-Chloroaniline | 7.3 | 3.65 | UM 18 | -- |
| Chlorobenzene | 0.5 | 0.25 | UM 20 | 6.0 |
| Chloroethane | 1.9 | 0.95 | UM 20 | -- |
| Chloroform | 0.5 | 0.25 | UM 20 | 5.0 |
| Chloromethane | 3.2 | 1.6 | UM 20 | 10.0 |
| 2-Chloronapthalene | 0.5 | 0.25 | UM 18 | -- |
| 4-Chloro-3-methylphenol | 4.0 | 2.0 | UM 18 | -- |
| 2-Chlorophenol | 0.99 | 0.495 | UM 18 | 20.0 |
| 4-Chlorophenyl-phenylether | 5.1 | 2.55 | UM 18 | -- |
| Chrysene | 2.4 | 1.2 | UM 18 | 20.0 |
| 4,4'-DDD | 0.019 | 0.0095 | UH 13 | 0.04 |
| 4,4'-DDE | 0.025 | 0.0125 | UH 13 | 0.04 |
| 4,4'-DDT | 0.034 | 0.017 | UH 13 | 0.06 |
| Dibenzo(a,h)anthracene | 6.5 | 3.25 | UM 18 | 20.0 |
| Dibenzofuran | 1.7 | 0.85 | UM 18 | -- |
| Dibromochloromethane | 0.67 | 0.335 | UM 20 | 6.0 |
| Di-n-butylphthalate | 3.7 | 1.85 | UM 18 | 20.0 |
| 1,2-Dichlorobenzene | 1.7 | 0.85 | UM 18 | 9.0 |
| 1,3-Dichlorobenzene | 1.7 | 0.85 | UM 18 | 9.0 |
| 1,4-Dichlorobenzene | 1.7 | 0.85 | UM 18 | 20.0 |
| 3,3-Dichlorobenzidine | 12 | 6.0 | UM 18 | 60.0 |
| 1,1-Dichloroethane | 0.68 | 0.34 | UM 20 | -- |
| 1,2-Dichloroethane | 0.50 | 0.25 | UM 20 | 3.0 |
| **1,1-Dichloroethene** | **0.50** | **0.25** | **UM 20** | **6.0** |

TABLE 4-5
LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS
FOR TCL ANALYTES IN SURFACE WATER
MAG-1 AREA CONTAMINANTS BOLDED[g]

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

| TCL ANALYTE | USAEC SURFACE WATER CRL (µg/L) | USAEC SURFACE WATER COD (µg/L) | USAEC CERTIFIED SURFACE WATER METHOD NUMBER | SURFACE WATER LOC (µg/L) |
|---|---|---|---|---|
| **1,2-Dichloroethene** | **0.50** | **0.25** | **UM 20** | **4.0** |
| Dichloromethane | 2.3 | 1.15 | UM 20 | -- |
| cis-1,3-Dichloropropene | 0.58 | 0.29 | UM 20 | 5.0 |
| trans-1,3-Dichloropropene | 0.70 | 0.35 | UM 20 | 7.0 |
| 1,2-Dichloropropane | 0.50 | 0.25 | UM 20 | * 5700[a] |
| Dieldrin | 0.018 | 0.009 | UH 13 | 0.03 |
| Diethylphthalate | 2.0 | 1.0 | UM 18 | 10.0 |
| Dimethylphthalate | 1.5 | 0.75 | UM 18 | 10.0 |
| 2,4-Dinitrotoluene | 4.5 | 2.25 | UM 18 | 10.0 |
| 2,6-Dinitrotoluene | 0.79 | 0.395 | UM 18 | 70.0[b] |
| Di-n-octyl phthalate | 15 | 7.5 | UM 18 | -- |
| Endrin | 0.018 | 0.009 | UH 13 | 0.04 |
| Ethylbenzene | 0.5 | 0.25 | UM 20 | 6.0 |
| Fluoranthene | 3.3 | 1.65 | UM 18 | 10.0 |
| Fluorene | 3.7 | 1.85 | UM 18 | 10.0 |
| Heptachlor | 0.042 | 0.021 | UH 13 | 0.02 |
| Heptachlor epoxide | 0.024 | 0.012 | UH 13 | 0.40 |
| Hexachlorobenzene | 1.6 | 0.8 | UM 18 | 10.0 |
| Hexachlorobutadiene | 3.4 | 1.7 | UM 18 | 10.0 |
| Hexachlorocyclo-pentadiene | 8.6 | 4.3 | UM 18 | 10.0 |
| Hexachloroethane | 1.5 | 0.75 | UM 18 | 10.0 |
| Indeno(1,2,3-cd)pyrene | 8.6 | 4.3 | UM 18 | 20.0 |
| Isophorone | 4.8 | 2.4 | UM 18 | 10.0 |
| Methoxychlor | 0.057 | 0.0285 | UH 13 | 0.20 |
| 2-Methylnaphthalene | 1.7 | 0.85 | UM 18 | -- |

TABLE 4-5
LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS
FOR TCL ANALYTES IN SURFACE WATER
MAG-1 AREA CONTAMINANTS BOLDED[g]

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

| TCL ANALYTE | USAEC SURFACE WATER | | USAEC CERTIFIED SURFACE WATER METHOD NUMBER | SURFACE WATER LOC (µg/L) |
|---|---|---|---|---|
| | CRL (µg/L) | COD (µg/L) | | |
| 4-Methyl-2-pentanone | 3.0 | 1.5 | UM 20 | -- |
| Naphthalene | 0.5 | 0.25 | UM 18 | * 620[a] |
| 2-Nitroaniline | 4.3 | 2.15 | UM 18 | -- |
| 3-Nitroaniline | 4.9 | 2.45 | UM 18 | -- |
| 4-Nitroaniline | 5.2 | 2.6 | UM 18 | -- |
| Nitrobenzene | 0.5 | 0.25 | UM 18 | 10.0 |
| N-Nitroso-di-n-propylamine | 4.4 | 2.2 | UM 18 | -- |
| N-Nitrosodiphenylamine | 3.0 | 1.5 | UM 18 | 20.0 |
| PCBs[e]: | | | | 0.5 |
| Aroclor 1016 | 0.16 | 0.08 | UH02 | |
| Aroclor 1221[f] | 0.16 | 0.08 | UH02 | |
| Aroclor 1232[f] | 0.16 | 0.08 | UH02 | |
| Aroclor 1242[f] | 0.19 | 0.095 | UH02 | |
| Aroclor 1248[f] | 0.19 | 0.095 | UH02 | |
| Aroclor 1254[f] | 0.19 | 0.095 | UH02 | |
| Aroclor 1260 | 0.19 | 0.095 | UH02 | |
| Pentachlorophenol | 18.0 | 9.0 | UM 18 | 30.0 |
| Phenanthrene | 0.5 | 0.25 | UM 18 | 10.0 |
| Phenol | 9.2 | 4.6 | UM 18 | 10.0 |
| Pyrene | 2.8 | 1.4 | UM 18 | 20.0 |
| Styrene | 0.5 | 0.25 | UM 20 | -- |
| Tetrachloroethylene | 1.6 | 0.8 | UM 20 | 9.0 |
| 1,1,2,2-Tetrachloroethane | 0.51 | 0.255 | UM 20 | 10.0 |
| Toluene | 0.5 | 0.25 | UM 20 | 6.0 |
| Toxaphene[d] | 1.35 | 0.675 | UH 13 | 1.0 |
| 1,2,4-Trichlorobenzene | 1.8 | 0.9 | UM 18 | 10.0 |
| 1,1,1-Trichloroethane | 0.5 | 0.25 | UM 20 | 6.0 |
| 1,1,2-Trichloroethane | 1.2 | 0.6 | UM 20 | 6.0 |

# TABLE 4-5
## LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TCL ANALYTES IN SURFACE WATER MAG-1 AREA CONTAMINANTS BOLDED[g]

## QUALITY ASSURANCE PROJECT PLAN
## FORT DIX RI/FS MAG-1 AREA

| TCL ANALYTE | USAEC SURFACE WATER CRL (µg/L) | USAEC SURFACE WATER COD (µg/L) | USAEC CERTIFIED SURFACE WATER METHOD NUMBER | SURFACE WATER LOC (µg/L) |
|---|---|---|---|---|
| **Trichloroethene** | **0.5** | **0.25** | **UM 20** | **5.0** |
| 2,4,5-Trichlorophenol | 5.2 | 2.6 | UM 18 | 10.0 |
| 2,4,6-Trichlorophenol | 4.2 | 2.1 | UM 18 | 20.0 |
| Vinyl acetate | 8.3 | 4.15 | UM 20 | -- |
| Vinyl chloride | 2.6 | 1.3 | UM 20 | 10.0 |
| Total xylenes | 0.84 | 0.42 | UM 20 | -- |

**Notes:**

CRL Certified Reporting Limit
COD Criteria of Detection, extended detection limits = 0.5 * CRL
LOC Level of Concern. Defined as the NJDEPE Surface Water PQL, unless otherwise noted. NJDEPE Surface Water PQLs from N.J.A.C. 7:9-4, New Jersey's Surface Water Quality Standards (NJDEPE, October 1992).
PQL Practical Quantitation Limits
NJDEPE New Jersey Department of Environmental Protection and Energy
-- No guideline or standard available.
(a) Federal Surface Water Quality Criteria. Freshwater Chronic Criteria.
(b) Federal Surface Water Quality Criteria. Water and fish consumption.
(c) Both the CRL and COD are slightly greater than the LOC. The COD will be reported to the USAEC data base when the analyte is not detected.
(d) Although the CRL is greater than the LOC, the COD is less than the LOC. The COD will be reported to the USAEC data base when the analyte is not detected.
(e) The analysis of the Aroclors is certified by the first and last Aroclor, 1016 and 1260, respectively. In addition, if the associated spikes and duplicates are in control for Aroclor 1016 and Aroclor 1260, as required by the certified method, the analysis for Aroclors is considered to be in control.
(f) The detection limits for these analytes are non-certified.
(g) MAG-1 Area contaminants identified from Dames and Moore 1993 Phase II RI.

## Table 4-6
## Levels of Concern and Associated Certified Reporting Limits for TAL Metals in Surface Water

### Quality Assurance Project Plan
### Fort Dix RI/FS MAG-1 Area

| Analyte | USAEC Surface Water CRL µg/L | USAEC Surface Water COD µg/L | USAEC Certified Surface Water Method Number | Surface Water LOC µg/L |
|---|---|---|---|---|
| Aluminum | 141 | 70.5 | SS10 | 200. |
| Antimony | 3.03 | 1.52 | SD28 | 20.0 |
| Arsenic | 2.54 | 1.27 | SD22 | 8.0 |
| Barium | 5.0 | 2.5 | SS10 | 20.0 |
| Beryllium | 5.0 | 2.5 | SS10 | 20.0 |
| Cadmium | 4.01 | 2.0 | SS10 | 4.0 |
| Chromium | 6.0 | 3.0 | SS10 | 10.0 |
| Copper | 8.1 | 4.05 | SS10 | 10.0 |
| Iron | 38.8 | 19.4 | SS10 | 100. |
| Lead | 1.26 | 0.63 | SD21 | 10.0 |
| Manganese | 2.75 | 1.375 | SS10 | 6.0 |
| Mercury | 0.243 | 0.122 | SB01 | 1.0 |
| Nickel | 7.11 | 3.56 | SS18 | 10.0 |
| Selenium | 3.02 | 1.51 | SD20 | 10.0 |
| Silver | 0.25 | 0.125 | SD23 | 2.0 |
| Sodium | 500 | 250 | SS10 | 400. |
| Thallium | 6.99 | 3.50 | SD09 | 10.0 |
| Vanadium | 11.0 | 5.5 | SS10 | -- |
| Zinc | 21.1 | 10.55 | SS10 | 30.09 |

**Notes:**

| | |
|---|---|
| NTAM | Entered into the USAEC IRDMIS database as a non-performance demonstrated method. |
| MCAWW | Methods for Chemical Analysis of Water and Wastewater, MCAWW EPA-600/4-79-020, March 1983. |
| IR | Infrared Spectrophotometer |
| – | No guidelines or standards available. |
| CRL | Certified Reporting Limit |
| COD | Criteria of Detection, extended detection limits = 0.5 * CRL |
| LOC | Level of Concern. Defined as the NJDEPE Surface Water PQL, unless otherwise noted. NJDEPE Surface Water PQLs from N.J.A.C. 7:9-4, New Jersey's Surface Water Quality Standards, NJDEPE, October 1992. For inorganics, the "natural background" concentrations will also be considered for LOCs. "Natural inorganic background" concentrations will be established from analytical results from background samples and published regional background data. |
| NJDEPE | New Jersey Department of Environmental Protection and Energy |
| PQL | Practical Quantitation Limits. This is an estimated value, which is dependent on the sample matrix and instrumentation. |
| — | No guideline or standard available. |

# TABLE 4-7
## LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TCL ANALYTES IN SEDIMENT MAG-1 AREA CONTAMINANTS BOLDED[e]

## QUALITY ASSURANCE PROJECT PLAN
## FORT DIX RI/FS MAG-1 AREA

| TCL ANALYTE | USAEC SEDIMENT CRL (mg/kg) | USAEC SEDIMENT COD (mg/kg) | USAEC CERTIFIED SEDIMENT METHOD NUMBER | SEDIMENT LOC (MG/KG) ER-L/ER-M[a] |
|---|---|---|---|---|
| Acenaphthene | 0.036 | 0.018 | LM 18 | 0.15/0.65 |
| Acenaphthylene | 0.033 | 0.0165 | LM 18 | -- |
| Acetone | 0.017 | 0.0085 | LM 19 | -- |
| Aldrin | 0.00729 | 0.00364 | LH 10 | -- |
| Anthracene | 0.033 | 0.0165 | LM 18 | 0.085/0.96 |
| Benzene | 0.0015 | 0.00075 | LM 19 | -- |
| Benzo(a)anthracene | 0.17 | 0.085 | LM 18 | 0.23/1.6 |
| Benzo(b)fluoranthene | 0.21 | 0.105 | LM 18 | -- |
| Benzo(k)fluoranthene | 0.066 | 0.033 | LM 18 | -- |
| Benzo(ghi)perylene | 0.25 | 0.125 | LM 18 | -- |
| Benzo(a)pyrene | 0.25 | 0.125 | LM 18 | 0.40/2.5 |
| Benzyl alcohol | 0.19 | 0.095 | LM 18 | -- |
| Benzylbutylphthalate | 0.17 | 0.085 | LM 18 | -- |
| gamma BHC (lindane) | 0.00638 | 0.0032 | LH 10 | -- |
| Bis(2chloroethoxy)-methane | 0.059 | 0.030 | LM 18 | -- |
| Bis(2-chloroethyl)ether | 0.033 | 0.016 | LM 18 | -- |
| Bis(2-chloroisopropyl)ether | 0.2 | 0.10 | LM 18 | -- |
| Bis(2-ethylhexyl) phthalate | 0.62 | 0.31 | LM 18 | -- |
| Bromodichloromethane | 0.0029 | 0.0014 | LM 19 | -- |
| Bromoform | 0.0069 | 0.0034 | LM 19 | -- |
| Bromomethane | 0.0057 | 0.0028 | LM 19 | -- |
| 4-Bromophenyl-phenylether | 0.033 | 0.016 | LM 18 | -- |
| 2-Butanone | 0.07 | 0.035 | LM 19 | -- |
| Carbon disulfide | 0.0044 | 0.0022 | LM 19 | -- |

# TABLE 4-7
## LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TCL ANALYTES IN SEDIMENT MAG-1 AREA CONTAMINANTS BOLDED[e]

## QUALITY ASSURANCE PROJECT PLAN
## FORT DIX RI/FS MAG-1 AREA

| TCL ANALYTE | USAEC SEDIMENT CRL (mg/kg) | USAEC SEDIMENT COD (mg/kg) | USAEC CERTIFIED SEDIMENT METHOD NUMBER | SEDIMENT LOC (MG/KG) ER-L/ER-M[a] |
|---|---|---|---|---|
| Carbon tetrachloride | 0.007 | 0.0035 | LM 19 | -- |
| Chlordane[d] | 0.0177 | 0.0088 | LH 10 | 0.0005/0.006 |
| 4-Chloroaniline | 0.81 | 0.405 | LM 18 | -- |
| Chlorobenzene | 0.00086 | 0.00043 | LM 19 | -- |
| Chloroethane | 0.012 | 0.006 | LM 19 | -- |
| Chloroform | 0.00087 | 0.00043 | LM 19 | -- |
| Chloromethane | 0.0088 | 0.0044 | LM 19 | -- |
| 2-Chloronapthalene | 0.036 | 0.018 | LM 18 | -- |
| 4-Chloro-3-methylphenol | 0.095 | 0.0475 | LM 18 | -- |
| 2-Chlorophenol | 0.06 | 0.03 | LM 18 | -- |
| 4-Chlorophenyl-phenylether | 0.033 | 0.0165 | LM 18 | -- |
| Chrysene | 0.12 | 0.06 | LM 18 | 0.4/2.8 |
| 4,4'-DDD | 0.00826 | 0.00413 | LH 10 | -- |
| 4,4'-DDE | 0.00765 | 0.00038 | LH 10 | -- |
| 4,4'-DDT | 0.00707 | 0.00035 | LH 10 | -- |
| Dibenzo(a,h)anthracene[d] | 0.21 | 0.105 | LM 18 | 0.06/0.26 |
| Dibenzofuran | 0.035 | 0.0175 | LM 18 | -- |
| Dibromochloromethane | 0.0031 | 0.00155 | LM 19 | -- |
| Di-n-butylphthalate | 0.061 | 0.0305 | LM 18 | -- |
| **1,2-Dichlorobenzene** | **0.11** | **0.055** | **LM 18** | **--** |
| 1,3-Dichlorobenzene | 0.13 | 0.065 | LM 18 | -- |
| 1,4-Dichlorobenzene | 0.098 | 0.049 | LM 18 | -- |
| 3,3-Dichlorobenzidine | 6.3 | 3.15 | LM 18 | -- |
| 1,1-Dichloroethane | 0.0023 | 0.0012 | LM 19 | -- |
| 1,2-Dichloroethane | 0.0017 | 0.0008 | LM 19 | -- |
| 1,1-Dichloroethene | 0.0039 | 0.0020 | LM 19 | -- |

TABLE 4-7
LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TCL ANALYTES IN SEDIMENT
MAG-1 AREA CONTAMINANTS BOLDED[a]

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

| TCL ANALYTE | USAEC SEDIMENT CRL (mg/kg) | USAEC SEDIMENT COD (mg/kg) | USAEC CERTIFIED SEDIMENT METHOD NUMBER | SEDIMENT LOC (MG/KG) ER-L/ER-M[a] |
|---|---|---|---|---|
| 1,2-Dichloroethene | 0.003 | 0.0015 | LM 19 | -- |
| Dichloromethane | 0.012 | 0.006 | LM 19 | -- |
| cis-1,3-Dichloropropene | 0.0032 | 0.0016 | LM 19 | -- |
| trans-1,3-Dichloropropene | 0.0028 | 0.0014 | LM 19 | -- |
| 1,2-Dichloropropane | 0.0029 | 0.0014 | LM 19 | -- |
| Dieldrin | 0.00629 | 0.00314 | LH 10 | -- |
| Diethylphthalate | 0.24 | 0.12 | LM 18 | -- |
| Dimethylphthalate | 0.17 | 0.085 | LM 18 | -- |
| 2,4-Dinitrotoluene | 0.14 | 0.07 | LM 18 | -- |
| 2,6-Dinitrotoluene | 0.085 | 0.0425 | LM 18 | -- |
| Di-n-octyl phthalate | 0.19 | 0.095 | LM 18 | -- |
| Endrin | 0.00657 | 0.0033 | LH 10 | -- |
| Ethylbenzene | 0.0017 | 0.0085 | LM 19 | -- |
| Fluoranthene | 0.068 | 0.034 | LM 18 | 0.6/3.6 |
| Fluorene | 0.033 | 0.0165 | LM 18 | -- |
| Heptachlor | 0.00618 | 0.0031 | LH 10 | -- |
| Heptachlor epoxide | 0.0062 | 0.0031 | LH 10 | -- |
| Hexachlorobenzene | 0.033 | 0.0165 | LM 18 | -- |
| Hexachlorobutadiene | 0.23 | 0.115 | LM 18 | -- |
| Hexachlorocyclo-pentadiene | 6.2 | 3.1 | LM 18 | -- |
| Hexachloroethane | 0.15 | 0.075 | LM 18 | -- |
| Indeno(1,2,3-cd)pyrene | 0.29 | 0.145 | LM 18 | -- |
| Isophorone | 0.033 | 0.0165 | LM 10 | -- |
| Methoxychlor | 0.0711 | 0.0356 | LH 10 | -- |
| 2-Methylnaphthalene | 0.049 | 0.0245 | LM 18 | 0.065/0.67 |
| 4-Methyl-2-pentanone | 0.027 | 0.0135 | LM 19 | -- |

TABLE 4-7
LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TCL ANALYTES IN SEDIMENT
MAG-1 AREA CONTAMINANTS BOLDED[e]

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

| TCL ANALYTE | USAEC SEDIMENT CRL (mg/kg) | USAEC SEDIMENT COD (mg/kg) | USAEC CERTIFIED SEDIMENT METHOD NUMBER | SEDIMENT LOC (MG/KG) ER-L/ER-M[a] |
|---|---|---|---|---|
| Naphthalene | 0.037 | 0.0185 | LM 18 | 0.34/2.1 |
| 2-Nitroaniline | 0.062 | 0.31 | LM 18 | -- |
| 3-Nitroaniline | 0.45 | 0.225 | LM 18 | -- |
| 4-Nitroaniline | 0.41 | 0.205 | LM 18 | -- |
| Nitrobenzene | 0.045 | 0.225 | LM 18 | -- |
| N-Nitroso-di-n-propylamine | 0.2 | 0.1 | LM 18 | -- |
| N-Nitrosodiphenylamine | 0.19 | 0.095 | LM 18 | -- |
| PCBs[b]: | | | | -- |
| Aroclor 1016 | 0.0666 | 0.0333 | LH 16 | |
| Aroclor 1221[c] | 0.0666 | 0.0333 | LH 16 | |
| Aroclor 1232[c] | 0.0666 | 0.0333 | LH 16 | |
| Aroclor 1242[c] | 0.0804 | 0.0402 | LH 16 | |
| Aroclor 1248[c] | 0.0804 | 0.0402 | LH 16 | |
| Aroclor 1254[c] | 0.0804 | 0.0402 | LH 16 | |
| Aroclor 1260 | 0.0804 | 0.0402 | LH 16 | |
| Pentachlorophenol | 1.3 | 0.65 | LM 18 | -- |
| Phenanthrene | 0.033 | 0.0165 | LM 18 | 0.225/1.38 |
| Phenol | 0.11 | 0.055 | LM 18 | -- |
| Pyrene | 0.033 | 0.0165 | LM 18 | 0.35/2.2 |
| Styrene | 0.0026 | 0.0013 | LM 19 | -- |
| Tetrachloroethylene | 0.00081 | 0.00040 | LM 19 | -- |
| 1,1,2,2-Tetrachloroethane | 0.0024 | 0.0012 | LM 19 | -- |
| Toluene | 0.00078 | 0.00039 | LM 19 | -- |
| Toxaphene | 0.444 | 0.222 | LH 10 | -- |
| 1,2,4-Trichlorobenzene | 0.04 | 0.02 | LM 18 | -- |
| 1,1,1-Trichloroethane | 0.0044 | 0.0022 | LM 19 | -- |
| 1,1,2-Trichloroethane | 0.0054 | 0.0027 | LM 19 | -- |
| **Trichloroethene** | **0.0028** | **0.0014** | **LM 19** | **--** |
| 2,4,5-Trichlorophenol | 0.10 | 0.05 | LM 18 | -- |

# TABLE 4-7
## LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TCL ANALYTES IN SEDIMENT MAG-1 AREA CONTAMINANTS BOLDED[e]

## QUALITY ASSURANCE PROJECT PLAN FORT DIX RI/FS MAG-1 AREA

| TCL ANALYTE | USAEC SEDIMENT CRL (mg/kg) | USAEC SEDIMENT COD (mg/kg) | USAEC CERTIFIED SEDIMENT METHOD NUMBER | SEDIMENT LOC (MG/KG) ER-L/ER-M[a] |
|---|---|---|---|---|
| 2,4,6-Trichlorophenol | 0.17 | 0.085 | LM 18 | -- |
| Vinyl acetate | 0.0032 | 0.016 | LM 19 | -- |
| Vinyl chloride | 0.0062 | 0.0031 | LM 19 | -- |
| Total xylenes | 0.0015 | 0.00075 | LM 19 | -- |

**Notes:**

When the CRL and/or COD are greater than the LOC, the specific cleanup objectives are to be determined on a case-by-case basis.

| | |
|---|---|
| CRL | Certified Reporting Limit |
| COD | Criteria of Detection, extended detection limits = 0.5 * CRL |
| LOC | Level of Concern. Based on the ER-L and ER-M reference numbers used to identify the presence of contamination exceeding levels potentially harmful to aquatic life. Specific cleanup objectives are to be determined on a case-by-case basis. ER-L is the concentration at the low end of the range in which adverse biological effects have been observed and ER-M is tha concentration approximately midway in the range of reported values associated with adverse biological effects. Guidance for Sediment Quality Evaluations (NJDEPE 1991), "Summary of ER-L and ER-M, Concentrations for Selected Chemicals in Sediment", Source: NOAA 1990. |
| PQL | Practical Quantitation Limits |
| — | No guideline or standard available. |
| (a) | ER-L and ER-M concentrations presented in dry weight. |
| (b) | The analysis of the Aroclors is certified by the first and last Aroclor, 1016 and 1260, respectively. In addition, if the associated spikes and duplicates are in control for Aroclor 1016 and Aroclor 1260, as required by the certified method, the analysis for Aroclors is considered to be in control. |
| (c) | The detection limits for these analytes are non-certified. |
| (d) | Both the CRL and COD are slightly greater than the estimated LOC. The COD will be reported to the USAEC data base when the analyte is not detected. |
| (e) | MAG-1 Area contaminants identified from Dames and Moore 1993 Phase II RI. |

TABLE 4-8
LEVELS OF CONCERN AND ASSOCIATED CERTIFIED
REPORTING LIMITS FOR TAL ANALYTES IN SEDIMENT

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

| ANALYTE | USAEC SEDIMENT | | USAEC CERTIFIED SEDIMENT METHOD NUMBER | SEDIMENT LOC MG/KG ER-L/ER-M[a] |
|---|---|---|---|---|
| | CRL mg/kg | COD mg/kg | | |
| **TAL Analytes** | | | | |
| Aluminum | 2.35 | 1.18 | JS16 | -- |
| Antimony | 7.14 | 3.57 | JS16 | 2.0/25.0 |
| Arsenic | 0.250 | 0.125 | JD19 | 33.0/85.0 |
| Barium | 5.13 | 2.59 | JS16 | -- |
| Beryllium | 0.5 | 0.25 | JS16 | -- |
| Cadmium | 0.7 | 0.35 | JS16 | 5.0/9.0 |
| Chromium | 4.05 | 2.03 | JS16 | 80.0/145. |
| Copper | 0.965 | 0.48 | JS16 | 70.0/390. |
| Cyanide | 0.92 | 0.46 | KY01 | -- |
| Iron | 3.68 | 1.84 | JS16 | -- |
| Lead | 10.5 | 5.25 | JS16 | 35.0/110. |
| Manganese | 2.05 | 1.03 | JS16 | -- |
| Mercury | 0.05 | 0.025 | JB01 | 0.15/1.3 |
| Nickel | 1.71 | 0.055 | JS16 | 30.0/50.0 |
| Selenium | 0.25 | 0.125 | JD15 | -- |
| Silver | 0.589 | 0.295 | JS16 | 1.0/2.2 |
| Sodium | 100.0 | 50.0 | JS16 | -- |
| Thallium | 0.50 | 0.25 | JD24 | -- |
| Vanadium | 3.39 | 1.70 | JS16 | -- |
| Zinc | 8.03 | 4.02 | JS16 | 120./270. |

# TABLE 4-8
## LEVELS OF CONCERN AND ASSOCIATED CERTIFIED REPORTING LIMITS FOR TAL ANALYTES IN SEDIMENT

## QUALITY ASSURANCE PROJECT PLAN
## FORT DIX RI/FS MAG-1 AREA

| ANALYTE | USAEC SEDIMENT | | USAEC CERTIFIED SEDIMENT METHOD NUMBER | SEDIMENT LOC MG/KG ER-L/ER-M[a] |
|---|---|---|---|---|
| | CRL mg/kg | COD mg/kg | | |
| TOC | PQL 5.0 | N/A | SW-846 9060 | -- |

**Notes:**

| | |
|---|---|
| EPA CE/81-1 | "EPA/Army Corps of Engineers Oil and Grease Procedures for Sediment Samples" |
| MCAWW | Methods for Chemical Analysis of Water and Wastewater, MCAWW EPA-600/4-79-020, March 1983. |
| SW-846 | Test Methods for Evaluating Solid Waste, USEPA SW-846, Third Edition, September 1986 with all current revisions. |
| CRL | Certified Reporting Limit |
| COD | Criteria of Detection, extended detection limits = 0.5 * CRL |
| TOC | Total Organic Carbon |
| LOC | Level of Concern. Based on the ER-L and ER-M reference numbers used to identify the presence of contamination exceeding levels potentially harmful to aquatic life. Specific cleanup objectives are to be determined on a case-by-case basis. ER-L is the concentration at the low end of the range in which adverse biological effects have been observed and ER-M is tha concentration approximately midway in the range of reported values associated with adverse biological effects. Guidance for Sediment Quality Evaluations (NJDEPE 1991), "Summary of ER-L and ER-M, Concentrations for Selected Chemicals in Sediment", Source: NOAA 1990. |
| PQL | Practical Quantitation Limits. This is an estimated value, which is dependent upon the sample matrix and instrumentation. |
| — | No guideline or standard available. |
| (a) | ER-L and ER-M concentrations presented in dry weight. |

## Table 4-9
## Sediment Quality Criteria for Selected Organic Compounds

### Quality Assurance Project Plan
### Fort Dix RI/FS MAG-1 Area

| Compound | Sediment Criterion (μg/g Carbon) (top # is FW criterion, botton # SW criterion) 95% Confidence Interval Mean | Lower | Upper |
|---|---|---|---|
| | Mean | Lower | Upper |
| Acenaphthene | 730<br>NA | 180<br>NA | 3030<br>NA |
| DDT | 0.828<br>0.828 | 0.183<br>0.183 | 3.80<br>3.80 |
| Dieldrin | 0.130<br>0.130 | 0.00976<br>0.00976 | 1.79<br>1.79 |
| Endrin | 0.0532<br>0.0532 | 0.00654<br>0.00654 | 0.443<br>0.443 |
| Ethyl Parathion | 0.0810<br>NA | 0.0160<br>NA | 0.416<br>NA |
| Heptachlor | 0.110<br>0.104 | 0.0148<br>0.014 | 0.840<br>0.795 |
| Lindane | 0.157<br>NA | 0.0394<br>NA | 0.636<br>NA |
| Phenanthrene | 139<br>102 | 32.6<br>23.8 | 605<br>442 |
| PCB (1245)* | 19.5<br>41.8 | 3.87<br>8.29 | 99.9<br>214 |

**Notes:**

* should be used as a surrogate for PCBs in general
FW = fresh water
SW = salt water
NA = not available

The sediment quality criteria are reference numbers used to identify the presence of contamination exceeding levels potentially harmful to aquatic life. Specific cleanup objectives are to be developed on a case-by-case basis.

TABLE 5-1
SAMPLE PRESERVATION, BOTTLE REQUIREMENTS, AND HOLDING TIMES FOR AQUEOUS SAMPLES

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

| ANALYTE | BOTTLE REQUIREMENT[1] AND VOLUME | REQUIRED HEADSPACE | PRESERVATIVE | HOLDING TIME |
|---|---|---|---|---|
| Total TAL Metals | Type C (1) | 10% | $HNO_3$ to pH<2, Cool to 4°C | 6 months, except Mercury (13 days) |
| TCL Volatile Organic Compounds | Type B (4) | 0% | HCl to pH<2, Cool to 4°C | 14 days |
| TCL Semivolatile Organic Compounds | Type H (2) | 10% | Cool to 4°C | 7 days to extraction (40 days after extraction to analysis) |
| TCL Pesticides/ PCBs* | Type H (3) | 10% | Cool to 4°C | 7 days to extraction (40 days after extraction to analysis) |
| Total Petroleum Hydrocarbons/ Oil and Grease | Type H (2) | 10% | $H_2S0_4$ to pH<2, Cool to 4°C | 28 days |
| Explosives | Type H (2) | 10% | Cool to 4°C | 7 days to extraction (40 days after extraction) |
| TOC, Nitrate and Phosphate | Type C (1) | 10% | $H_2SO_4$ to pH<2, Cool to 4°C | 28 days |
| Nitrite and Sulfate | Type C (1) | 10% | Cool to 4°C | 48 hours (Nitrite) 28 days (Sulfate) |

**Notes:**

Type A Container: 80-oz amber glass, ring handle bottle/jug, 38-mm neck finish.
Closure: White polypropylene or black phenolic, baked polyethylene cap, 38-430 size; 0.015-mm teflon liner.
Type B Container: 40-mL glass vial, 24mm neck finish.
Closure: White polypropylene or black phenolic, open-top, screw cap, 15-cm opening, 24-400 size.
Septum: 24-mm disc of 0.005-in teflon bonded to 0.120-in silicon for total thickness of 0.125-in.
Type C Container: 1-L high density polyethylene, cylinder-round bottle, 28-mm neck finish.
Closure: White polyethylene cap, white ribbed, 28-410 size; F217 polyethylene liner.
Type H Container: 1-L amber, Boston round, glass bottle, 33-mm pour-out neck finish.
Closure: White polypropylene or black phenolic, baked polyethylene cap, 33-430 size; 0.015-mm teflon liner.
Type K Container: 4-L amber glass, ring handle bottle/jug, 38-mm neck finish.
Closure: White polypropylene or black phenolic, baked polyethylene cap, 38-430 size; 0.015-mm teflon liner.
Type L Container: 500-mL high-density polyethylene, cylinder-round bottle, 28-mm neck finish.
Closure: White polypropylene cap, white ribbed, 28-410 size; F217 polyethylene liner.
Type M Container: 125-mL high-density polyethylene cylinder-round bottle, 28-mm neck finish.
Closure: White polypropylene cap, white ribbed, 28-410 size; F217 polyethylene liner.
* A variety of products, including PCB fluids, were marketed by Monsanto between 1972 and 1978 distinguished by a four-digit code accompanying the "Aroclor" trademark. About 50% of the total volume of these products, principally in the form of Aroclors 1221, 1242, 1248, 1254, and 1260 were used in domestic fluids. The last two digits of the 1200 series Aroclors represent the weight percent of chlorine for the mixture. These Aroclors are the principal components of an electrical transformers' dielectric fluid, and the principal constituent of the EPA TCL PCB fraction.

# TABLE 5-2

## SAMPLE PRESERVATION, BOTTLE REQUIREMENTS, AND HOLDING TIMES FOR SOIL AND SEDIMENT SAMPLES

## QUALITY ASSURANCE PROJECT PLAN FORT DIX RI/FS MAG-1 AREA

| ANALYTE | BOTTLE REQUIREMENT-VOLUME* | REQUIRED HEADSPACE | PRESERVATIVE | HOLDING TIME |
|---|---|---|---|---|
| Soil Samples | | | | |
| TAL Metals | Type H (2) | 10% | Cool to 4°C | 6 months, except Mercury (28 days) |
| TCL Volatile Organic Compounds | Type B (2) | 0% | Cool to 4°C | 10 days |
| TCL Semivolatile Organic Compounds | Type H (2) | 10% | Cool to 4°C | 7 days to extraction (40 days after extraction to analysis) |
| Total Petroleum Hydrocarbons | Type H (2) | NA | Cool to 4°C | 28 days |
| TCL Pesticides/PCBs* | Type H (2) | 10% | Cool to 4°C | 7 days to extraction (40 days after extraction to analysis) |
| Total Organic Carbon | Type H (2) | NA | Cool to 4°C | 14 days |
| Explosives | Type H (2) | 10% | Cool to 4°C | 7 days to extraction (40 days after extraction to analysis) |
| Oil and Grease | Type H (2) | 10% | Cool to 4°C | 14 days to extraction (40 days after extraction to analysis) |

**Notes:**

Type B Container: 125-mL glass vial, 24mm neck finish
Closure: White polypropylene or black phenolic, open-top, screw cap, 15-cm opening, 24-400 size.
Septum: 24-mm disc of 0.005-in Teflon bonded to 0.120-in silicon for total thickness of 0.125-in.

Type F Container: 8-oz. short, wide mouth, straight-sided, flint glass jar, 70-mm neck finish.
Closure: White polypropylene or black phenolic, baked polyethylene cap, 48-400 size; 0.030-mm Teflon liner.

Type H Container: 250mL wide mouth, straight-sided, amber glass.
Closure: White polypropylene with Teflon liner.

Type I Container: 4-oz. short, wide mouth, straight-sided, flint glass jar, 70-mm neck finish.
Closure: White polypropylene or black phenolic, baked polyethylene cap, 48-400 size; 0.030-mm Teflon liner.

NA = Not Applicable
* = All non-VOC analyses will be collected in two Type H containers. Sample extraction and analysis will be made from these containers.

# TABLE 5-3
## SAMPLE PRESERVATION, BOTTLE REQUIREMENTS, AND HOLDING TIMES FOR SOIL AND SEDIMENT SAMPLES FOR PHYSICAL ANALYSES

## QUALITY ASSURANCE PROJECT PLAN
## FORT DIX RI/FS MAG-1 AREA

| ANALYTE | BOTTLE REQUIREMENT* | REQUIRED HEADSPACE | PRESERVATIVE | HOLDING TIME |
|---|---|---|---|---|
| Atterberg limits | 1-L mason jar | 10% | none | none |
| Grain size | 1-L mason jar | 10% | none | none |

**Note:**

* All analyses can be performed from one 1-L sample volume.

TABLE 6-1
PROJECT ANALYTE LIST
MAG-1 AREA CONTAMINANTS BOLDED[1]

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

| ANALYTE GROUP | USAEC METHOD NUMBER[2] | USAEC ANALYTE | TCL/ TAL[3] ANALYTE |
|---|---|---|---|
| VOCs | LM19 Soil<br>UM20 Water | **1,2-Dichloroethenes/1,2-Dichloroethylenes (cis and trans isomers)** | ✓ |
| | | Dichlorobenzenes | |
| | | trans-1,3-Dichloropropene | ✓ |
| | | Ethylbenzene | ✓ |
| | | **Styrene/Ethenylbenzene/Styrol/Styrolene/ Cinnamene/Cinnamol/Phenylethylene/Vinylbenzene** | ✓ |
| | | Acrolein | |
| | | 1,2-Dichloroethane | ✓ |
| | | Acrylonitrile | ✓ |
| | | Acetic acid vinyl ester/Vinyl acetate | |
| | | Methyl isobutyl ketone/Isopropylacetone/ 4-Methyl-2-pentanone | |
| | | **Toluene** | ✓ |
| | | Chlorobenzene/Monochlorobenzene | ✓ |
| | | (2-Chloroethoxy)ethene/2-Chloroethyl vinyl ether | |
| | | cis-1,3-Dichloropropene/cis-1,3-Dichloropropylene | ✓ |
| | | Xylenes | ✓ |
| | | Dibromochloromethane/Chlorodibromomethane | ✓ |
| | | **Tetrachloroethene/Tetrachloroethylene/ Perchloroethylene/Ethylene tetrachloride/Nema/ Tetracap/Tetropil** | ✓ |
| | | Carbon tetrachloride | ✓ |
| | | **Acetone** | ✓ |
| | | Chloroform | ✓ |
| | | **Benzene** | ✓ |
| | | **1,1,1-Trichloroethane** | ✓ |
| | | Bromomethane | ✓ |
| | | Chloromethane | ✓ |

**TABLE 6-1**
**PROJECT ANALYTE LIST**
**MAG-1 AREA CONTAMINANTS BOLDED[1]**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| ANALYTE GROUP | USAEC METHOD NUMBER[2] | USAEC ANALYTE | TCL/ TAL[3] ANALYTE |
|---|---|---|---|
| VOCs (cont.) | LM19 Soil<br>UM20 Water | Chloroethane | ✓ |
| | | Chloroethene/Vinyl chloride | ✓ |
| | | Methylene chloride/Dichloromethane | ✓ |
| | | Carbon disulfide | ✓ |
| | | Bromoform | ✓ |
| | | Bromodichloromethane | ✓ |
| | | 1,1-Dichloroethene/1,1-Dichloroethylene | ✓ |
| | | 1,1-Dichloroethane | ✓ |
| | | Trichlorofluoromethane | |
| | | 1,2-Dichloropropane | ✓ |
| | | 2-Butanone/Methyl ethyl ketone | ✓ |
| | | 1,1,2-Trichloroethane | ✓ |
| | | **Trichloroethene/Trichloroethylene/Ethinyl trichloride/Tri-Clene/Trielene/Trilene** | ✓ |
| | | 1,1,2,2-Tetrachloroethane/Tetrachloroethane/Acetylene tetrachloride/Cellon/Bonoform | ✓ |
| | | 2-Hexanone/Methyl n-butyl ketone | ✓ |
| **SVOCs** | LM18 Soil<br>UM18 Water | 4-Bromophenyl phenyl ether | ✓ |
| | | 4-Chlorophenyl phenyl ether | ✓ |
| | | 4-Nitroaniline | ✓ |
| | | 4-Nitrophenol | ✓ |
| | | Benzyl alcohol | |
| | | Toxaphene/Chlorinated camphene/Camphechlor/Alltox/ /Genephene/Motox/Penphene/Phenacide/Phenatox | |
| | | alpha-Chlordane | |
| | | PCB 1221 | |
| | | 2,4-Dimethylphenol | ✓ |

TABLE 6-1
PROJECT ANALYTE LIST
MAG-1 AREA CONTAMINANTS BOLDED[1]

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

| ANALYTE GROUP | USAEC METHOD NUMBER[2] | USAEC ANALYTE | TCL/ TAL[3] ANALYTE |
|---|---|---|---|
| SVOCs (cont.) | LM18 Soil<br>UM18 Water | Benzo[b]fluoranthene/3,4-Benzofluoranthene | ✓ |
| | | 2,6-Dinitrotoluene | ✓ |
| | | Fluoranthene | ✓ |
| | | 4-Cresol/4-Methylphenol/p-Cresol | ✓ |
| | | 1,4-Dichlorobenzene | ✓ |
| | | 4-Chloroaniline | ✓ |
| | | Benzo[k]fluoranthene | ✓ |
| | | Bis(2-chloroisopropyl) ether/2,2'-oxybis(1-chloropropane) | ✓ |
| | | Phenol/Carbolic acid/Phenic acid/Phenylic acid/Phenyl hydroxide/Hydroxybenzene/Oxybenzene | ✓ |
| | | Acenaphthylene | ✓ |
| | | Aldrin | |
| | | Bis(2-chloroethyl) ether | ✓ |
| | | Bis(2-chloroethoxy) methane | ✓ |
| | | 1,2-Diphenylhydrazine | |
| | | beta-Endosulfan/Endosulfan II | |
| | | Bis(2-ethylhexyl) phthalate | ✓ |
| | | Di-n-octyl phthalate | ✓ |
| | | Chrysene | ✓ |
| | | Hexachlorobenzene | ✓ |
| | | alpha-Benzenehexachloride/alpha-Hexachlorocyclohexane | |
| | | beta-Benzenehexachloride/beta-Hexachlorocyclohexane | |
| | | delta-Benzenehexachloride/delta-Hexachlorocyclohexane | |
| | | Anthracene | ✓ |
| | | 1,2,4-Trichlorobenzene | ✓ |
| | | 2,4-Dichlorophenol | ✓ |
| | | 2,4-Dinitrotoluene | ✓ |

**TABLE 6-1**
**PROJECT ANALYTE LIST**
**MAG-1 AREA CONTAMINANTS BOLDED[1]**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| ANALYTE GROUP | USAEC METHOD NUMBER[2] | USAEC ANALYTE | TCL/ TAL[3] ANALYTE |
|---|---|---|---|
| SVOCs (cont.) | LM18 Soil<br>UM18 Water | N-Nitrosodi-n-propylamine | ✓ |
| | | Endrin aldehyde | |
| | | Heptachlor epoxide | |
| | | Pyrene/Benzo[def]phenanthrene | ✓ |
| | | Tetradecane | |
| | | Endosulfan sulfate | |
| | | Dimethyl phthalate | ✓ |
| | | Dibenzofuran | ✓ |
| | | 2-Methyl-4,6-dinitrophenol/4,6-Dinitro-2-methylphenol | ✓ |
| | | PCB 1232 | |
| | | 1,3-Dichlorobenzene | ✓ |
| | | 2,2-Bis(p-chlorophenyl)-1,1,1-trichloroethane | |
| | | Benzo[a]pyrene | ✓ |
| | | 2,4-Dinitrophenol | ✓ |
| | | Dibenz[ah]anthracene/1,2:5,6-Dibenzanthracene | ✓ |
| | | Benzo[a]anthracene | ✓ |
| | | gamma-Benzenehexachloride/gamma-Hexachlorocyclohexane/Lindane | |
| | | 3-Methyl-4-chlorophenol/4-Chloro-3-cresol/ 4-Chloro-3-methylphenol/4-Chloro-m-cresol | ✓ |
| | | alpha-Endosulfan/Endosulfan I | |
| | | Dieldrin | |
| | | N-Nitrosodimethylamine/ N-Methyl-N-nitrosomethanamine/DMN/DMNA | |
| | | Benzoic acid | |
| | | gamma-Chlordane | |
| | | Hexachloroethane | ✓ |
| | | PCB 1242 | |

**TABLE 6-1**
**PROJECT ANALYTE LIST**
**MAG-1 AREA CONTAMINANTS BOLDED[1]**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| ANALYTE GROUP | USAEC METHOD NUMBER[2] | USAEC ANALYTE | TCL/ TAL[3] ANALYTE |
|---|---|---|---|
| SVOCs (cont.) | LM18 Soil<br>UM18 Water | Endrin | |
| | | PCB 1248 | |
| | | Methoxychlor/Methoxy-DDT/1,1'-(2,2,2-Trichloroethylidene)-bis[4-methoxybenzene] | |
| | | 1,1-Dichloro-2,2-bis(p-chlorophenyl)ethane/Rhothane/TDE/ppDDD/1,1'-(2,2-Dichloroethylidene)bis[4-chlorobenzene] | |
| | | 2,2-Bis(p-chlorophenyl)-1,1-dichloroethene | |
| | | PCB 1016 | |
| | | Heptachlor/1H-1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene | |
| | | Hexachlorocyclopentadiene | ✓ |
| | | Isophorone | ✓ |
| | | Acenaphthene | ✓ |
| | | Diethyl phthalate | ✓ |
| | | Di-n-butyl phthalate | ✓ |
| | | Phenanthrene | ✓ |
| | | Butylbenzyl phthalate | ✓ |
| | | N-Nitrosodiphenylamine | ✓ |
| | | Fluorene/9H-Fluorene | ✓ |
| | | 9H-Carbazole/Carbazole | ✓ |
| | | Hexachloro-1,3-butadiene/Hexachlorobutadiene | ✓ |
| | | Pentachlorophenol | ✓ |
| | | 2,4,6-Trichlorophenol | ✓ |
| | | 2-Nitroaniline | ✓ |
| | | 2-Nitrophenol | ✓ |
| | | Naphthalene/Tar camphor | ✓ |
| | | Benzo[ghi]perylene | ✓ |

**TABLE 6-1**
**PROJECT ANALYTE LIST**
**MAG-1 AREA CONTAMINANTS BOLDED[1]**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| ANALYTE GROUP | USAEC METHOD NUMBER[2] | USAEC ANALYTE | TCL/ TAL[3] ANALYTE |
|---|---|---|---|
| SVOCs (cont.) | LM18 Soil<br>UM 18 Water | 2-Methylnaphthalene | ✓ |
| | | 2-Chloronaphthalene | ✓ |
| | | 3,3'-Dichlorobenzidine | ✓ |
| | | Tridecane | |
| | | Benzidine | |
| | | Indeno[1,2,3-C,D]pyrene | ✓ |
| | | Endrin ketone | |
| | | 2-Cresol/2-Methylphenol/o-Cresol | ✓ |
| | | 1,2-Dichlorobenzene | ✓ |
| | | 2-Chlorophenol | ✓ |
| | | 2,4,5-Trichlorophenol | ✓ |
| | | PCB 1260 | |
| | | PCB 1254 | |
| | | Nitrobenzene/Essence of mirbane/Oil of mirbane | ✓ |
| | | 3-Nitroaniline | ✓ |
| **PESTICIDES** | LH10 Soil<br>UM13 Water | Toxaphene/Chlorinated camphene/Camphechlor/Alltox/ Genephene/Motox/Penphene/Phenacide/Phenatox/ | ✓ |
| | | alpha-Chlordane | ✓ |
| | | Aldrin | ✓ |
| | | beta-Endosulfan/Endosulfan II | ✓ |
| | | alpha-Benzenehexachloride/alpha-Hexachlorocyclohexane | ✓ |
| | | beta-Benzenehexachloride/beta-Hexachlorocyclohexane | ✓ |
| | | delta-Benzenehexachloride/delta-Hexachlorocyclohexane | ✓ |
| | | Endrin aldehyde | ✓ |
| | | Heptachlor epoxide | ✓ |
| | | Endosulfan sulfate | |
| | | 2,2-Bis(p-chlorophenyl)-1,1,1-trichloroethane | |

TABLE 6-1
PROJECT ANALYTE LIST
MAG-1 AREA CONTAMINANTS BOLDED[1]

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

| ANALYTE GROUP | USAEC METHOD NUMBER[2] | USAEC ANALYTE | TCL/ TAL[3] ANALYTE |
|---|---|---|---|
| Pesticides (cont.) | LH10 Soil<br>UH13 Water | gamma-Benzenehexachloride/gamma-Hexachlorocyclohexane/Lindane | ✓ |
| | | alpha-Endosulfan/Endosulfan I | ✓ |
| | | Dieldrin | ✓ |
| | | Isodrin | |
| | | gamma-Chlordane | ✓ |
| | | Endrin | ✓ |
| | | Methoxychlor/Methoxy-DDT/1,1'-(2,2,2-Trichloroethylidene)-bis[4-methoxybenzene] | ✓ |
| | | 1,1-Dichloro-2,2-bis(p-chlorophenyl)ethane/Rhothane/TDE/ppDDD/1,1'-(2,2-Dichloroethylidene)bis[4-chlorobenzene] | |
| | | 2,2-Bis(p-chlorophenyl)-1,1-dichloroethene | ✓ |
| | | Heptachlor/1H-1,4,5,6,7,8,8-Heptachloro-3a,4,7, | ✓ |
| | | 7a-tetrahydro-4,7-methanoindene | |
| | | Endrin ketone | ✓ |
| **PCBs** | LH16 Soil<br>UH02 Water | PCB 1221 | ✓ |
| | | PCB 1232 | ✓ |
| | | PCB 1242 | ✓ |
| | | PCB 1248 | ✓ |
| | | PCB 1016 | ✓ |
| | | PCB 1260 | ✓ |
| | | PCB 1254 | ✓ |
| **EXPLOSIVES** | UW32 Water | 2,6-Dinitrotoluene | ✓ |
| | | 2,4,6-Trinitrotoluene/alpha-Trinitrotoluene | |
| | | 2,4-Dinitrotoluene | ✓ |
| | | **RDX/Cyclonite/Hexahydro-1,3,5-trinitro-1,3,5-triaz Hexogen** | |

**TABLE 6-1**
**PROJECT ANALYTE LIST**
**MAG-1 AREA CONTAMINANTS BOLDED[1]**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| ANALYTE GROUP | USAEC METHOD NUMBER[2] | USAEC ANALYTE | TCL/ TAL[3] ANALYTE |
|---|---|---|---|
| Explosives (cont.) | UW32 Water | Tetryl/N-Methyl-N,2,4,6-tetranitroaniline/Nitramine | |
| | | **HMX/Cyclotetramethylenetetranitramine** | |
| | | Nitrobenzene/Essence of mirbane/Oil of mirbane | ✓ |
| | | 1,3,5-Trinitrobenzene | |
| | | 1,3-Dinitrobenzene | |
| | | 4-Amino-2,6-Dinitrotoluene | |
| | | 2-Amino-4,6-Dinitrotoluene | |
| | | 2-Nitrotoluene | |
| | | 3-Nitrotoluene | |
| | | 4-Nitrotoluene | |
| | LW12 Soil | 2,6-Dinitrotoluene | ✓ |
| | | 2,4,6-Trinitrotoluene/alpha-Trinitrotoluene | |
| | | 2,4-Dinitrotoluene | ✓ |
| | | RDX/Cyclonite/Hexahydro-1,3,5-trinitro-1,3,5-triaz Hexogen | |
| | | Nitroglycerine/1,2,3-Propanetriol trinitrate | |
| | | PETN/Pentaerythritol tetranitrate/2,2-Bis[(nitroox methyl]-1,3-propanediol dinitrate (ester) | |
| | | Tetryl/N-Methyl-N,2,4,6-tetranitroaniline/Nitramine | |
| | | HMX/Cyclotetramethylenetetranitramine | |
| | | Nitrobenzene/Essence of mirbane/Oil of mirbane | ✓ |
| | | 1,3,5-Trinitrobenzene | |
| | | 1,3-Dinitrobenzene | |
| **METALS** | JB01 Soil/SB01 Water | Mercury | ✓ |
| | JD15 Soil/SD21 Water | Selenium | ✓ |
| | JD17 Soil/SD20 Water | Lead | ✓ |
| | JD19 Soil/SD22 Water | Arsenic | ✓ |

**TABLE 6-1**
**PROJECT ANALYTE LIST**
**MAG-1 AREA CONTAMINANTS BOLDED[1]**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| ANALYTE GROUP | USAEC METHOD NUMBER[2] | USAEC ANALYTE | TCL/ TAL[3] ANALYTE |
|---|---|---|---|
| Metals (cont.) | JD18 Soil/SD23 Water | Silver | ✓ |
| | JD24 Soil/SD09 Water | Thallium | ✓ |
| | JD16 Soil/SD19 Water | Vanadium | ✓ |
| | JD25 Soil/SD28 Water | Antimony | ✓ |
| | JS16 Soil/SS10 Water | Aluminum | ✓ |
| | | Iron | ✓ |
| | | Magnesium | ✓ |
| | | Manganese | ✓ |
| | | Nickel | ✓ |
| | | Potassium | ✓ |
| | | Sodium | ✓ |
| | | Barium | ✓ |
| | | Beryllium | ✓ |
| | | Cadmium | ✓ |
| | | Chromium | ✓ |
| | | Cobalt | ✓ |
| | | Copper | ✓ |
| | | Zinc | ✓ |
| | | Calcium | ✓ |
| **OIL AND GREASE** | 00 Soil | | |
| **TPH** | 00 Soil | | |
| **TOC** | 00 Soil | | |

**Notes:**

| | | |
|---|---|---|
| 1 Bolded | = | MAG-1 Area contaminants identified from Dames and Moore 1993 Phase II RI |
| 2 S | = | Soil/Sediment |
| 3 TCL | = | Target Compound List (VOCs and SVOCs) |
| G | = | Groundwater/Surface Water |
| TAL | = | Target Analyte List (Metals) |

**TABLE 6-2**
**ESE LABORATORY CRLs AND URLs FOR TCL VOLATILE ORGANIC COMPOUNDS**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| ANALYTE | USAEC ACRONYM | SOLID-LOW CONC. (µg/g) | | AQUEOUS (µg/L) | |
|---|---|---|---|---|---|
| | | CRL[a] | URL[a] | CRL[a] | URL[a] |
| 1,1-Dichloroethane | 11DCLE | 0.0023 | 0.20 | 0.68 | 200 |
| 1,1-Dichloroethylene | 11DCE | 0.0039 | 0.10 | 0.50 | 200 |
| 1,1,1-Trichloroethane | 111TCE | 0.0044 | 0.20 | 0.50 | 200 |
| 1,1,2-Trichloroethane | 112TCE | 0.0054 | 0.02 | 1.2 | 200 |
| 1,1,2,2-Tetrachloroethane | TCLEA | 0.0024 | 0.20 | 0.51 | 200 |
| 1,2-Dichloroethane | 12DCLE | 0.0017 | 0.20 | 0.50 | 50 |
| 1,2-Dichloropropane | 12DCLP | 0.0029 | 0.20 | 0.50 | 200 |
| 2-Butanone | MEK | 0.0700 | 0.20 | 6.4 | 200 |
| 4-Methyl-2-pentanone | MIBK | 0.0270 | 0.10 | 3.0 | 200 |
| Acetone | ACET | 0.0170 | 0.10 | 13.0 | 50 |
| Benzene | C6H6 | 0.0015 | 0.20 | 0.50 | 200 |
| Bromodichloromethane | BRDCLM | 0.0029 | 0.20 | 0.59 | 200 |
| Bromoform | CHBR3 | 0.0069 | 0.20 | 2.6 | 200 |
| Bromomethane | CH3BR | 0.0057 | 0.20 | 5.8 | 100 |
| Carbon disulfide | CS2 | 0.0044 | 0.10 | 0.50 | 200 |
| Carbon tetrachloride | CCL4 | 0.0070 | 0.20 | 0.58 | 200 |
| Chlorobenzene | CLC6H5 | 0.00086 | 0.20 | 0.50 | 200 |
| Chloroethane | C2H5CL | 0.0120 | 0.20 | 1.9 | 200 |
| Chloroform | CHCL3 | 0.00087 | 0.20 | 0.50 | 200 |
| Chloromethane | CH3CL | 0.0088 | 0.10 | 3.2 | 200 |
| Dibromochloromethane | DBRCLM | 0.0031 | 0.20 | 0.67 | 100 |
| 1,2-Dichloroethene (total) | 12DCE | 0.0030 | 0.10 | 0.50 | 200 |
| *cis*-1,3-Dichloropropene | C13DCP | 0.0032 | 0.0032 | 0.58 | 230 |
| *trans*-1,3-Dichloropropene | T13DCP | 0.0028 | 0.152 | 0.70 | 280 |
| Ethylbenzene | ETC6H5 | 0.0017 | 0.20 | 0.50 | 200 |
| Hexanone | MNBK | 0.0320 | 0.10 | 3.6 | 200 |
| Methylene chloride | CH2CL2 | 0.0120 | 0.20 | 2.3 | 100 |
| Styrene | STYR | 0.0026 | 0.20 | 0.5 | 200 |
| Tetrachloroethylene | TCLEE | 0.00081 | 0.20 | 1.6 | 200 |
| Toluene | MEC6H5 | 0.00078 | 0.20 | 0.50 | 200 |
| Trichloroethylene | TRCLE | 0.0028 | 0.20 | 0.50 | 200 |
| Vinyl chloride | C2H3CL | 0.0062 | 0.20 | 2.6 | 200 |
| Xylene | XYLEN | 0.0015 | 0.20 | 0.84 | 200 |

**Notes:**

[a]CRL = Certified Reporting Limit
URL = Upper Reporting Limit.

CRLs and URLs from ESE Laboratory, Gainsville, FL

## TABLE 6-3
## ESE LABORATORY CRLs AND URLs FOR TCL SEMIVOLATILE ORGANIC COMPOUNDS

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

| ANALYTE | USAEC ACRONYM | SOLID ($\mu$g/g) | | AQUEOUS ($\mu$g/L) | |
|---|---|---|---|---|---|
| | | CRL[A] | URL[A] | CRL[A] | URL[A] |
| 1,2-Dichlorobenzene | 12DCLB | 0.110 | 13.0 | 1.70 | 50.0 |
| 1,2,4-Trichlorobenzene | 124TCB | 0.040 | 13.0 | 1.80 | 50.0 |
| 1,3-Dichlorobenzene | 13DCLB | 0.130 | 13.0 | 1.70 | 200 |
| 1,4-Dichlorobenzene | 14DCLB | 0.098 | 13.0 | 1.70 | 200 |
| 2-Chloronaphthalene | 2CNAP | 0.0360 | 13.0 | 0.50 | 200 |
| 2-Chlorophenol | 2CLP | 0.060 | 13.0 | 0.99 | 200 |
| 2-Methylnaphthalene | 2MNAP | 0.049 | 6.7 | 1.70 | 50.0 |
| 2-Methylphenol | 2MP | 0.029 | 1.3 | 3.90 | 200 |
| 2-Nitroaniline | 2ANIL | 0.062 | 13.0 | 4.30 | 100 |
| 2-Nitrophenol | 2NP | 0.14 | 13.0 | 3.70 | 100 |
| 2,4-Dichlorophenol | 24DCLP | 0.18 | 13.0 | 2.90 | 200 |
| 2,4-Dimethylphenol | 24DMPN | 0.69 | 1.3 | 5.80 | 100 |
| 2,4-Dinitrophenol | 24DNP | 1.20 | 6.7 | 21.0 | 100 |
| 2,4-Dinitrotoluene | 24DNT | 0.14 | 13.0 | 4.5 | 200 |
| 2,4,5-Trichlorophenol | 245TCP | 0.10 | 13.0 | 5.20 | 200 |
| 2,4,6-Trichlorophenol | 246TCP | 0.17 | 13.0 | 4.20 | 100 |
| 2,6-Dinitrotoluene | 26DNT | 0.085 | 13.0 | 0.79 | 200 |
| 3-Nitroaniline | 3NANIL | 0.450 | 13.0 | 4.90 | 100 |
| 3,3'-Dichlorobenzidine | 33DCBD | 6.30 | 13.0 | 12.0 | 100 |
| 4-Bromophenyl-phenyl ether | 4BRPPE | 0.033 | 6.7 | 4.20 | 100 |
| 4-Chloro-3-methylphenol | 4CL3C | 0.095 | 13.0 | 4.0 | 200 |
| 4-Chloroaniline | 4CANIL | 0.81 | 3.3 | 7.30 | 100 |
| 4-Chlorophenyl-phenylether | 4CLPPE | 0.033 | 13.0 | 5.10 | 100 |
| 4-Methylphenol | 4MP | 0.24 | 1.3 | 0.52 | 200 |
| 4-Nitroaniline | 4NANIL | 0.41 | 13.0 | 5.20 | 100 |
| 4-Nitrophenol | 4NP | 1.40 | 13.0 | 12.0 | 100 |
| 4,6-Dinitro-2-methylphenol | 46DN2C | 0.55 | 13.0 | 17.0 | 100 |
| Acenaphthene | ANAPNE | 0.036 | 13.0 | 1.70 | 50.0 |
| Acenaphthylene | ANAPYL | 0.033 | 6.7 | 0.50 | 50.0 |
| Anthracene | ANTRC | 0.033 | 13.0 | 0.50 | 100 |
| Benzo[a]pyrene | BAPYR | 0.25 | 13.0 | 4.70 | 100 |
| Benzo[b]fluoranthene | BBFAN | 0.21 | 3.3 | 5.40 | 50.0 |
| Benzo[g,h,i]perylene | BGHIPY | 0.25 | 3.3 | 0.610 | 50.0 |
| Benzo[k]fluoranthene | BKFANT | 0.66 | 0.67 | 0.87 | 100 |
| Benz[a]anthracene | BAANTR | 0.17 | 13.0 | 1.60 | 100 |
| Benzyl alcohol | BZALC | 0.19 | 13.0 | 0.72 | 100 |
| Bis(2-chloroethoxy)methane | B2CEXM | 0.059 | 13.0 | 1.50 | 50.0 |
| Bis(2-chloroethyl)ether | B2CLEE | 0.033 | 6.7 | 1.90 | 50.0 |
| Bis(2-chloroisopropyl)ether | B2CIPE | 0.20 | 13.0 | 5.30 | 200 |

TABLE 6-3
ESE LABORATORY CRLS AND URLS FOR TCL SEMIVOLATILE ORGANIC COMPOUNDS

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

| | | SOLID (μg/g) | | AQUEOUS (μg/L) | |
|---|---|---|---|---|---|
| Bis(2-ethylhexyl)phthalate | B2EHP | 0.62 | 13.0 | 4.80 | 100 |
| Benzylbutylphthalate | BBZP | 0.17 | 6.7 | 3.40 | 100 |
| Chrysene | CHRY | 0.12 | 6.7 | 2.40 | 100 |
| Di-n-butylphthalate | DNBP | 0.061 | 3.3 | 3.70 | 200 |
| Di-n-octylphthalate | DNOP | 0.19 | 6.7 | 15.0 | 100 |
| Dibenzofuran | FURANS | 0.035 | 6.7 | 1.7 | 50.0 |
| Dibenz[a,h]anthracene | DBAHA | 0.21 | 13.0 | 6.50 | 50.0 |
| Diethylphthalate | DEP | 0.24 | 6.7 | 2.0 | 200 |
| Dimethylphthalate | DMP | 0.17 | 13.0 | 1.50 | 100 |
| Fluoranthene | FANT | 0.068 | 13.0 | 3.30 | 100 |
| Fluorene | FLRENE | 0.033 | 13.0 | 3.70 | 50.0 |
| Hexachlorobenzene | CL6BZ | 0.033 | 6.7 | 1.60 | 100 |
| Hexachlorobutadiene | HCBD | 0.23 | 13.0 | 3.40 | 100 |
| Hexachlorocyclopentadiene | CL6CP | 6.20 | 13.0 | 8.60 | 100 |
| Hexachloroethane | CL6ET | 0.15 | 13.0 | 1.50 | 50.0 |
| Indeno(1,2,3-cd)pyrene | ICDPYR | 0.29 | 13.0 | 8.60 | 100 |
| Isophorone | ISOPHR | 0.033 | 13.0 | 4.80 | 50.0 |
| Nitrosodiphenylamine | NNDPA | .019 | 13.0 | 3.0 | 200 |
| Naphthalene | NAP | 0.037 | 3.3 | 0.50 | 20.0 |
| Nitrobenzene | NB | 0.045 | 13.0 | 0.50 | 40.0 |
| Pentachlorophenol | PCP | 0.033 | 6.7 | (1.0[c]) | - |
| Phenanthrene | PHANTR | 0.033 | 13.0 | 0.50 | 100 |
| Phenol | PHENOL | 0.110 | 3.3 | 9.20 | 200 |
| Pyrene | PYR | 0.033 | 3.3 | 2.80 | 100 |

**Notes:**

CRL[a] = Certified Reporting Limit
URL[a] = Upper Reporting Limit. CRLs and URLs from ESE Laboratory, Gainsville, FL.
[b] = Method detection limit.

## - TABLE 6-4
## USAEC CRLs AND URLs FOR TAL INORGANICS

### QUALITY ASSURANCE PROJECT PLAN
### FORT DIX RI/FS MAG-1 AREA

| ANALYTE | USAEC ACRONYM | SOLID (mg/kg) | | AQUEOUS (μg/L) | |
|---|---|---|---|---|---|
| | | CRL[a] | URL[a] | CRL[a] | URL[a] |
| Aluminum | AL | 2.35 | 50,000 | 141 | 500,000 |
| Antimony | SB | 7.14 | 5,000 | 3.03 | 200 |
| Arsenic | AS | 0.25 | 10.0 | 2.54 | 100 |
| Barium | BA | 5.18 | 2,500 | 5.0 | 10,000 |
| Beryllium | BE | 0.50 | 1,000 | 5.0 | 1,000 |
| Cadmium | CD | 0.70 | 1,000 | 4.01 | 5,000 |
| Calcium | CA | 59.0 | 5,000 | 500 | 500,000 |
| Chromium | CR | 4.05 | 5,000 | 6.02 | 5,000 |
| Cobalt | CO | 1.42 | 1,000 | 25.0 | 50,000 |
| Copper | CU | 0.965 | 2,500 | 8.1 | 10,000 |
| Cyanide | CN | 0.92 | 10.0 | 11.0 | 50.0 |
| Iron | FE | 3.68 | 50,000 | 38.8 | 500,000 |
| Lead | PB | 10.5 | 5,000 | 1.26 | 100 |
| Magnesium | MG | 50.0 | 5,000 | 500 | 500,000 |
| Manganese | MN | 0.275 | 5,000 | 2.75 | 50,000 |
| Mercury | HG | 0.05 | 1.0 | 0.243 | 10.0 |
| Nickel | NI | 1.71 | 5,000 | 7.11 | 50,000 |
| Potassium | K | 37.5 | 5,000 | 375 | 500,000 |
| Selenium | SE | 0.25 | 10.0 | 3.02 | 100 |
| Silver | AG | 0.589 | 10.0 | 0.25 | 10.0 |
| Sodium | NA | 100 | 50,000 | 500 | 500,000 |
| Thallium | TL | 0.50 | 10.0 | 6.99 | 25.0 |
| Vanadium | V | 3.39 | 1,000 | 11.0 | 1,000 |
| Zinc | ZN | 8.03 | 5,000 | 21.1 | 20,000 |

**Notes:**

[a]CRL = Certified Reporting Limit
URL = Upper Reporting Limit.
CRLs and URLs from ESE Laboratory, Gainsville, FL

TABLE 7-1
INFORMATION REQUIRED FOR GEOTECHNICAL AND CHEMICAL DATA ENTRY INTO IRDMIS

QUALITY ASSURANCE PROJECT PLAN
FORT DIX RI/FS MAG-1 AREA

| IRDMIS DATA ENTRY ELEMENTS | GEOTECHNICAL DATA ENTRY | CHEMICAL DATA ENTRY |
|---|---|---|
| Installation | X | X |
| Laboratory | | X |
| Sample | | X |
| Test Method | | X |
| Measurement Units | | X |
| Analyst | | X |
| Sample Number | | X |
| File Name | X | X |
| File Site Type | X | X |
| Site ID | X | X |
| Field Sampler Number | X | X |
| Sample Date | X | X |
| Sample Program | X | |
| Sample Depth (cm) | X | |
| Sample Technique | X | |
| Lab Analysis Number | | X |
| Sample Preparation Date | | X |
| Analysis Date | | X |
| Test Name | | X |
| Measurement Boolean | | X |
| Uncorrected Measurement Value | | X |
| Dilution Factor | | X |
| Percent Moisture | | X |
| Internal Standard Code | | X |
| QC Test | | X |
| QC Spike Value | | X |

# TABLE 8-1
## QUALITY CONTROL CRITERIA FOR ORGANIC AND INORGANIC CONSTITUENTS

## QUALITY ASSURANCE PROJECT PLAN
## FORT DIX RI/FS MAG-1 AREA

| TYPE | FREQUENCY[1] | CONTROL MEASURE |
|---|---|---|
| Blank | 1 | Surrogate Compounds |
| LCS[2] and/or Spiked Blank | 1 | % Recovery[3] |
| Duplicate | 1 | RPD[4] |

**Notes:**

1 Frequency based on a batch of 20 samples or less of a matrix, or per lot of samples extracted.
2 LCS = Laboratory Control Sample
3 Analyte of interest
4 RPD = Relative Percent Difference

**TABLE 13-1**
**FORT DIX REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORTS**

**QUALITY ASSURANCE PROJECT PLAN**
**FORT DIX RI/FS MAG-1 AREA**

| SEQUENCE NUMBER (ELIN) AND NAME | FREQUENCY | FIRST SUBMISSION | USATHAMA REG/REPRO COPIES |
|---|---|---|---|
| A001 Performance and Cost Report | Monthly (19) | — | 3/0 |
| A002 Progress/Status Meeting Report | per meeting | — | 3/0 |
| A003 Management Plan | One | 30 DATA | 5/0 D<br>5/0 F |
| A004 Technical Plan | One | 45 DATA | 15/0 D<br>15/0 DF<br>20/0 F |
| A005 Quality Control Plan | One | 45 DATA | 15/0 D<br>15/0 DF<br>20/1 F |
| A008 Health and Safety Plan | One | 45 DATA | 15/0 D<br>15/0 DF<br>20/0 F |
| A009 Technical Memorandum | One | 180 DATA | 5/0 D<br>10/0 F |
| A009 RI Report | One | 310 DATA | 15/0 D<br>15/0 DF<br>20/1 F |
| A009 FS Report | One | 400 DATA | 15/0 D<br>15/0 DF<br>20/1 F |
| A009 PP and ROD | One | 480 DATA | 15/0 D<br>15/0 DF<br>20/1 F |

**Notes:**

DATA = days after task award
D = draft
DF = draft final
F = final

# LEVEL B PURGE AND TRAP ANALYSIS OF VOLATILE ORGANIC COMPOUNDS BY FIELD GAS CHROMATOGRAPHY

## STANDARD OPERATING PROCEDURE

# APPENDIX A
# QUALITY ASSURANCE PROJECT PLAN
# FORT DIX RI/FS MAG-1 AREA

## LEVEL B PURGE AND TRAP ANALYSIS OF VOLATILE ORGANIC COMPOUNDS BY FIELD GAS CHROMATOGRAPHY STANDARD OPERATING PROCEDURE

**SCOPE:** This procedure describes the preparation and analysis of water samples for volatile organic compounds pertinent to the Ft. Dix MAG-1 Area field operations using purge and trap sample concentration followed by GC analysis.

## 1.0 INSTRUMENTATION AND MATERIALS

### 1.1 PURGE & TRAP DEVICE

A Tekmar LSC 2000 sample concentrator or equivalent model is used for most applications. The purge and trap (P&T) is a concentration device for volatiles in both soil and water. A sparger vessel (a removable glass tube) is used to hold either the water or soil sample. Helium is used to remove volatile compounds from the sample. A polymer trap is used to trap the volatiles as they are purged from the sample. After the volatiles are purged from the sample, the trap is flash heated and the volatiles are transferred to the GC for separation, identification, and quantitation.

Purge & Trap Run Conditions. Run conditions may be altered in project specific work plans, however, the following settings are recommended for most operations.

Tekmar LSC 2000 Purge & Trap with an optional 2016 Autosampler

purge time - 11 minutes
purge temperature - $\leq$ 40°C
desorb time - 4 minutes
desorb temperature - 220°C trap #1
bake time - 10 minutes
bake temperature - 225°C Trap #1
valve temperature - 180°C Trap #1

line temperature - 180°C Trap #1
bake gas delay - on 2 min
purge flow - helium 30 mL/min ± 5 mL/min
purge pressure - 30 psi
Trap #1 - Tenax
*These parameters may be altered according to the judgement of the field chemist

### 1.2 Gas Chromatograph

A wide range of temperature programmable gas chromatographs may be used for this method. For most field operations a Hewlett Packard 5890 Series II (or equivalent) temperature programmable GC is used. The instrument is durable, easy to assemble, and uses keypad input for operation.

GC Run Conditions. Run conditions may be altered to meet project specific needs by the field chemist. The following settings are applicable for most operations. The basic Ft. Dix MAG-1 Area field GC run conditions are listed as follows.

Instruments - HP 5890 Series II
OI ELCD
HP 3365 series II ChemStation

HP 5890 with ELCD

initial oven temperature - 40°C
initial time - 4 minutes
ramp - 6°C/min
final temperature - 200°C
injector temperature - 225°C
detector temperature - 275°C
ELCD temperature - 900°C + or - 25°C
column - DB-624 75 meters 0.53 mm ID megabore
carrier flow - helium 10 mL + or - 2 mL/min
make-up - helium 20 mL ± 5 mL/min
combustion gas - hydrogen 100 ± 10 mL/min
*These parameters may be altered according to the judgement of the field chemist

### 1.3 COLUMNS

A DB-624 0.53mm ID megabore column or equivalent will be used. The column may be 30, 60, 75, or 120 meters in length as long as the information is recorded.

### 1.4 DETECTOR

An electrolytic conductivity detector (ELCD) was chosen for the field program.

Electrolytic Conductivity Detector:

- Carrier Make-up Gas: Helium at 99.999% purity with a flow of 30 mL/minute ± 5 mL/minute.
- Combustion Gases: Hydrogen at 99.999% purity with a flow of 100 mL/minute ± 10 mL/minute.
- Reactor Temperature: 900°C ± 25°C.
- Solvent Flow: n-Propanol flow at 35% ± 5%, this is equivalent to 3.5 pump dial turns ± 0.5 turns.

### 1.5 REAGENT WATER

Reagent water or locally purchased distilled or spring water that has been demonstrated to be free of target analytes below the QLs. Reagent water may be purged with helium prior to use to remove VOCs. This is checked daily with method blanks.

## 2.0 DOCUMENTATION

To aid in organization, all field screening activities will follow strict QA/QC guidelines for coding standards, logbook entries, calculations, and quality control. Deviations from the guidelines outlined in this document will not be allowed without the issuance of a written field change request, a logbook entry detailing the reason(s) for any deviation(s), and a verbal discussion with the project chemist.

### 2.1 Documentation of Sample Receipt

A sample receipt logbook will be kept to track all samples to be analyzed by field GC. The sample receipt logbook will contain all chain of custody forms which are signed off by the field sampler and field chemist. Chain of custody will be maintained throughout the process.

### 2.2 Documentation of Sample Analysis

Each instrument will contain a logbook which contains a record of instrument operations. At a minimum this will include:

- A table of contents listing what and where specific information is located.
- A listing of P&T and GC run conditions and set points containing the following:
  - type of data collection system, either integrator or ChemStation
  - initial temperature (°C)
  - initial time (min.)
  - rate (°C/min.), for all ramps
  - final temperature (°C)
  - final time (min.)
  - injector temperature (°C)
  - detector temperature (°C)
  - type of detector(s)
  - column: type, length, and diameter
  - carrier gas and flow (mL/min.)

- make-up gas and flow (mL/min.)
- combustion gas and flow (mL/min.)
- type of purge and trap device
- purge flow (mL/min.)
- purge time (min.)
- contents of trap
- purge temperature (°C)
- desorb time (min.)
- bake time (min.)
- bake temperature (°C)
- line and valve temperature (°C

- A chemical standards preparation section containing the information necessary to trace sources of all standards, and to document the various dilution steps taken while preparing stock and working standards(see section 3.0 for details).

- A run log containing at a minimum:
  - sample identification
  - run number
  - computer file identification
  - sample amount (weight or volume)
  - injection amount (medium level)

- surrogate amount and % recovery

- standard reference for each standard used

- type and amount of standard(s) used

- dilution factors

- a remarks column with any pertinent information (i.e., unusual sample color or odor, unusable blanks, failed standards, coelutions, reruns, etc.)

- A summary of initial and continuing calibration standard quality control results. For all target compounds the correlation coefficient(r) for the initial calibration and the percent difference values for the continuing calibration will be recorded in the instrument logbook.

- An equipment maintenance section containing both routine and equipment malfunction maintenance (e.g., column replacement, electronic parts replacement, lamp replacement or cleaning, etc.)

## 3.0 STANDARD PREPARATION

### 3.1 STOCK CHEMICAL STANDARDS

Stock chemical standards will be purchased and traced from Supelco, Inc., Chem Service, Inc., or an equivalent supplier. All standard information necessary to trace the origin and preparation procedures will be included in the instrument logbook. This information will include, at a minimum:

- Vendor name supplying standards

- Name and concentration of the standard (this can be done by attaching the label from the standard to the logbook)

- Lot number of the standards

### 3.2 WORKING CHEMICAL STANDARDS

Working chemical standards may either be purchased through an approved vendor or prepared from stock standards. Working standards will be made by diluting neat or prepared stock standards with methanol. For standards made from neat solutions, the compound density will be used in calculating the appropriate dilutions and final standard concentration. All working standards will be labeled with an identification code (see below), compound or mix name, concentration, and expiration date. The instrument logbook will contain the following information, at a minimum:

- The Stock solution used to make the working standard, including either the information required for logging the stock solution or a reference to where that information can be found.
- Both a written and numeric description of how the working standard was prepared.
- The Methanol brand and associated lot number(s) used in preparing the standards.
- The final concentration of the working standard.
- The standard code associated with the standard.

Standard and stock solutions will be kept refrigerated at less than 10°C when not in use. The surrogate standard is made separately from the working standards. An independent check standard made with stock standards purchased from a separate vendor source will be analyzed. A percent difference of < 30% will be considered acceptable to confirm standard accuracy.

### 3.3 STANDARD CODING SYSTEM

The standard coding system is used to trace all standards back to the vendor. All standards are required to have the appropriate code assigned when they are prepared and must be labeled accordingly. The standard code will follow the format:

- FGCXXXXXXWWYZPPPP Where:

- XXXXXX is the month, day, and year that the standard was made, i.e, 041693 = April 16,1993.
- WW is the page in the logbook where the standard can be found, i.e., 01 to 99.
- Y is where the standard fell chronologically on the page, i.e., A through Z.
- Z is the logbook number where the standard can be found, i.e., 1 through 9.
- PPPP is the project identifier.

## 4.0 TARGET COMPOUNDS

Analytes of concern for the Ft. Dix MAG-1 Area are as follows: trans-1,2-dichloroethene, cis-1,2-dichloroethene, trichloroethene, vinyl chloride, and carbon tetrachloride.

Target compounds are identified in chromatograms by matching the retention time of peaks. The period of time from the moment of desorption of a mixture onto a column to the elution of peak of interest is the retention time. Retention times will be based on the last calibration run. A retention time window of 3% will be used for qualitative identification. Detection of target compounds will not be confirmed with a second column analysis.

A method detection limit (MDL) study will be conducted on each instrument to determine project-specific MDLs. A minimum of 7 replicate low level standard injections near the expected MDL will be analyzed. From these analyses a standard deviation is calculated and multiplied by the appropriate students t number for a 99% confidence interval, 3.143 in the case of 7 replicates, to calculate MDLs.

## 5.0 CALIBRATION

The calibration process involves two steps, compound identification and quantitation. Identification is accomplished by matching retention times of peaks to their known

order of elution and approximate elution times specified by the manufacturer. Quantitation will be performed using a multilevel external calibration curve.

### 5.1 INITIAL CALIBRATION

A calibration curve will be generated at the beginning of the field program, whenever an instrument is taken off-line for major maintenance, or whenever the continuing calibration does not meet criteria. A minimum of three concentrations, with one point at the reporting limit, will be used to calibrate each target compound. Standard concentrations will be at 3 $\mu$g/L, 10 $\mu$g/L, 20 $\mu$g/L, and 40 $\mu$g/L. The calibration curve will be generated using linear regression, not forcing the origin through zero. The correlation coefficient (r) value must be greater than or equal to 0.990 for each compound to be an acceptable initial calibration. If the instrument does not produce a linear response for all compounds than corrective actions including instrument maintenance or preparation of new standards will be done.

### 5.2 INDEPENDENT CHECK STANDARD VERIFICATION

After the first initial calibration for a project, an independent check standard will be analyzed when required by project DQO's. The check standard will be obtained from a different source than the stock solution and working standards. The check standard is used to verify the accuracy of the working standards and stock mixes. A percent difference of less than 30 percent is considered acceptable to confirm standard accuracy.

### 5.3 CONTINUING CALIBRATION

A continuing calibration consisting of a mid-level standard will be run at the beginning of each day, after every 10 samples, and at the end of each day. In the case of instruments running around the clock a continuing calibration will be run after every 10 samples. The percent difference from the initial calibration will be calculated for each analyte. Continuing calibration percent difference must be less than or equal to 20%. If a standard does not meet the calibration criteria, a second standing can be analyzed. If one or more analytes are outside of criteria a new initial calibration will be constructed.

$$\%D = \left| \frac{calc.\ amt.\ std.\ -\ spiked\ amt.\ std.}{spiked\ amt.\ std.} \right| * 100$$

## 6.0 BLANKS

There are two types of banks associated with purge and trap analysis; low level method blanks and cleaning blanks.

Low level Method Blanks. For routine analysis, a low level method blank must be analyzed each day before samples are analyzed. A low level method blank consist of 5 mL of analyte free water that has a surrogate added. Method blanks are acceptable if no target compounds are present above the MDL. Samples should not be analyzed until an acceptable method blank is run demonstrating that the instrument is free of interferences.

Cleaning Blanks. A cleaning blank is 5 mL of reagent water. Blanks may be analyzed after any high level sample(s) to ensure that carryover is not occurring. Chemists may also bake out purge and trap GC until a stable baseline is observed. A high level sample is defined as having a concentration 5 times higher than the highest calibration point. Cleaning blanks will be analyzed until the concentrations of all analytes are less than the MDL.

## 7.0 SAMPLE PREPARATION AND ANALYSIS

Sample analysis and preparation techniques have been adapted from protocols outlined in SW-846 3rd ed. USEPA Purge and Trap method 8010 (USEPA 1986).

### 7.1 Routine Analysis Order

The standards and samples are analyzed as outlined in the previous sections. The routine order of analysis is:

- Calibration standard(s) at the start of the project and a continuing calibration standard for each subsequent day (note: a new calibration may have to be run each day if the continuing calibration fails criteria, see calibration section).
- Independent check to verify calibration at the beginning of the project, if required (note: this standard is only analyzed once during the project).
- Method blank
- Samples
- Matrix spike and matrix spike duplicate (MS/MSD) samples if required.

### 7.2 Water Samples

Rinse a 5 mL syringe with one volume of sample. Draw the sample into the syringe, invert and remove all air adjusting the final volume to 5.0 mL. Add the appropriate amount of surrogate directly to the sample. Deliver the sample to the sparger and start the run. After the desorb and bake cycle, remove spent sample, rinse the sparger with reagent water prior to analyzing subsequent samples.

If high concentrations of VOC's are suspected (indicated by PID headspace results or odor), samples should be diluted to bring the target compound concentrations within the instrument calibration range. Sample volumes of 1 mL (dilutions of 1 to 5) or more may be measured in the 5 mL syringe and reagent water drawn directly into the syringe for a final volume of 5.0 mL. To dilute samples requiring a volume of less than 1 mL add 5.0 mL reagent water to the syringe. Then remove a volume equal to the volume of sample to be added. Add the sample volume and surrogate to the syringe using an appropriate size syringe.

If detected target compound results are outside the calibration range, results should be flagged with an E (E = estimated). Samples will not be diluted further to bringing target compounds into the linear range.

If target compounds or unknown peaks are not observed in the original analysis, the sample should be reanalyzed at a lower dilution, or at 5 mls, to verify absence of compounds at the MDL.

The results of diluted samples must be multiplied by a dilution factor to correct for volume change. The dilution factor and all volumes used should be recorded in the instrument logbook. Calculate the dilution factor as follows:

$$DF = 5\ mL/X$$

where X = sample volume, mL

## 8.0 QUALITY CONTROL

The following procedures will be implemented by the field chemist to insure standardization of the operating procedures:

### 8.1 PRELIMINARY REVIEW

The field chemist will review each chromatogram before reporting the data to the field operations leader. The review will include the calculation of surrogate recoveries, comparison of surrogate and target compound retention times to calibration standards, and the evaluation of carryover potential. All hardcopy chromatograms, quantitation reports, and calibration reports will be reviewed by a field chemist, and filed by date, instrument, and run order.

All unknown peaks greater than 10% area of the surrogate area will be recorded in the logbooks as unknowns. The detector will be listed. Unknowns may be used in decisionmaking if compound concentrations indicate significant possibility of contamination of non-target compounds exist.

### 8.2 SURROGATE

4-Bromofluorobenzene (BFB) will be added to each standard, blank, and sample as a surrogate to document system integrity. Surrogate recovery goals are 30 percent - 200 percent. If the percent recovery is < 30% the sample will be reanalyzed. If recoveries are still out of criteria on the second attempt the sample will be reported accordingly. Samples will not be reanalyzed if the BFB recovery exceeds 200 percent.

### 8.3 METHOD BLANKS

A method blank consisting of analyte free distilled water with an addition of surrogate will be analyzed at a minimum of once per day per instrument. Any analyte of concern that is detected in the method blank above the MDL will be qualified in any associated samples that have positive detections above the MDLs.

### 8.4 FIELD DUPLICATES

Duplicate samples will be collected in the field at a frequency of 10% and submitted to the on-site GC for analysis. The results of duplicate analyses will be used qualitatively to evaluate analytical and field sampling precision. The goal is 50 percent difference, or less, for target compound with results greater than 5X the MDL.

### 8.5 MATRIX SPIKE/MATRIX SPIKE DUPLICATES

Matrix Spike (MS/MSD) samples will be analyzed on one sample for each matrix from each site. Percent recoveries and relative percent difference will be calculated and reported in the instrument logbooks. MS/MSD results will be used for qualitative evaluation of the accuracy and precision of the method in respect to sample matrices encountered at the Ft. Dix MAG-1 Area.

### 8.6 RINSATE BLANK

Rinsate blanks will be collected in the field at a frequency of 1 per day per matrix and submitted to the on-site GC for analysis. Rinsates will be used as a preliminary check of the efficiency of instrument decontamination.

## 9.0 FIELD RESULT REPORTING

Data from all sample analyses and relevant calibration and blank analyses will be documented in the project GC run logbook. A quality control summary will be generated at the completion of the project and will include the following information: MS/MSD summary tables, field duplicates summary tables, and equipment rinseate summary tables.

## REFERENCE:

U.S. Environmental Protection Agency, 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods; SW-846"; Office of Solid Waste and Emergency Response, Washington, D.C.

## Appendix A
## Level B Gas Chromatography Field Screening QC Objectives

### Quality Assurance Project Plan
### Fort Dix RI/FS MAG-1 Area

| QC Parameter | Frequency | Q.C. Protocol | Corrective Actions |
|---|---|---|---|
| Method Detection Limit Study | Each instrument at beginning of field program | 7 standards<br>3X standard deviation | NA |
| Initial Calibration | Any time instrument undergone major maintenance or continuing calibration is unacceptable | * 3-point calibration, plus a blank<br>* $r = \geq 0.990$ | If initial calibration criteria is not met, instrument will be checked for problems. Instrument maintenance and corrective actions will be recorded. |
| Continuing Calibration | Beginning and ending of each day and also after every 10 samples | Percent recovery ± 20% | If continuing calibration criteria is not met, new initial calibration instrument will be checked for problems or new initial calibration conducted. |
| Method Blank | Daily | Target compounds must be below the Reporting Limit (RL). | If any compound is above the RL in the method blank, any associated positive result will be evaluated. Field chemist will use judgement to determine status of result. |
| Compound Quantitation | Each sample | * NA | * All compounds detected at concentrations greater than RLs will be recorded.<br>* Compounds detected above the highest calibration point will be flagged with an (E). |
| Surrogate Recoveries | Each sample | Percent recoveries must be between 30% and 200%. | Samples less than the control limit of 30% R will be reanalyzed to evaluate the potential for matrix effects. |
| Matrix Spike | Each site and each matrix | * The mid-level calibration standard is to be used as the spiking solution. | NA. Qualitative Evaluation. |
| Field Duplicates | 10% of samples | * less than 50 RPD for compound >5X RL. | NA. Qualitative Evaluation. |

# RDX EXPLOSIVES FIELD TEST KIT PROCEDURES

IMPORTANT: Read all instructions and handling procedures before using this kit. For assistance call the TECHNICAL SERVICE HOT LINE 1-800-222-0342.

## INTENDED USE

The D TECH™ TNT/RDX on-site and laboratory screening test kit is designed to provide quick, qualitative, and reliable test results for making environmental decisions.
The D TECH TNT/RDX test kit can be used on-site for identifying "hot spots", site mapping, monitoring of remediation process and selecting site samples for laboratory analysis.
In the laboratory, the D TECH TNT/RDX test can screen highly contaminated samples that require pre-dilution.

## PRINCIPLE

Trinitrotoluene (TNT) and hexahydro-1,3,5-trinitro-1,3,5-triazine(RDX) are components commonly found in military explosives. The presence of these compounds is an indicator of contaminated soil or water from explosive waste residues.
The D TECH system for assaying trace amounts of explosives is based on immunoassay technology. Antibodies specific for TNT and RDX have been linked to solid particles which are trapped on the membrane of a detection cup.
A color developing solution added to the surface of the detection cup develops a color inversely proportional (less color more TNT/RDX present in sample) to the concentration of TNT or RDX in the sample.
Separate collection wells on the surface of the detection cup allow individual determination of TNT and RDX at parts per million (ppm) and parts per billion (ppb) in soil and water samples, respectively.
For technical information on Enzyme Linked Immuno Sorbent Assay, ask for Technical Bulletin #1 ELISA.

## TEST KIT DESCRIPTION

D TECH TNT/RDX EXPLOSIVES TEST KIT #TK-1001 contains sufficient materials to perform four (4) determinations. This kit can test four (4) water samples or be used with the D TECH TNT/RDX SOIL EXTRACTION PAC #TK-1001S to test soil samples.
The TNT/RDX SOIL EXTRACTION PAC contains only the materials needed to extract the TNT/RDX compounds from soil for measurement with this D TECH TNT/RDX EXPLOSIVES test kit.

**MATERIALS PROVIDED:**

- Black Top Calibration Pipet (4)
- BOTTLE A (4)
- TNT VIAL (4)
- RDX VIAL (4)
- Reagent D "YELLOW CAP" (4)
- Reagent E "BLUE CAP" (4)
- Reagent F "RED CAP" (4)
- White Cup Assembly (4)
- Snap -In Filter Tips (4)
- Used Kit Label (1)
- Instruction Guide (1)
- Color Chart (1)

**ACCESSORIES SUPPLIED BY USER:**

- Timing Device (minutes)
- SOIL EXTRACTION PAC Item TK-1001S-1 (if testing soil samples)

## HEALTH/SAFETY

Material Safety Iata Sheets (MSDS) have been supplied with the purchase of this product. The MSDS should be read before using this test. Included in this section we have emphasized health and safety precautions that should be followed when handling these solutions.

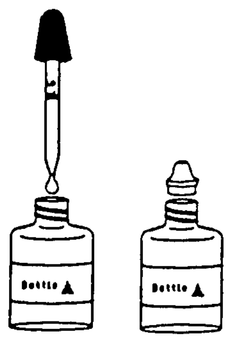
**PROTECT EYES WITH SAFETY GLASSES**
**POROTECT SKIN WITH PROTECTIVE GLOVES**

# INSTRUCTION GUIDE

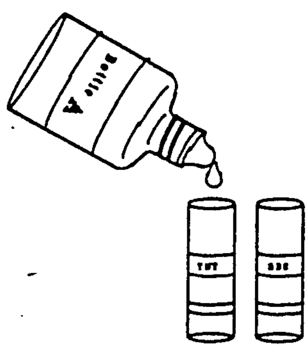
**This package is designed to serve as a WORK STATION. At the conclusion of the test, the components can be left in the package for proper disposal.**

## TEST PROCEDURE

**Step 1:** Using the calibration pipet, transfer 1 ml water sample (or Bottle 2 from D TECH TNT/RDX Soil Extraction Pac, item TK-1001S-1) to **Bottle "A"**, snap filter tip into place on bottle. Shake gently.

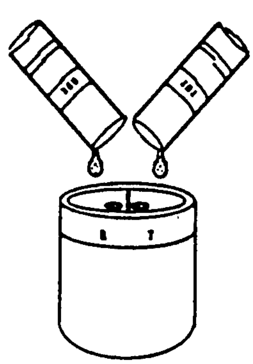


**Step 2:** Squeeze Bottle "A" filling the TNT Vial to a level between the two lines (approximately 13-14 drops); gently mix. Repeat for the RDX Vial.

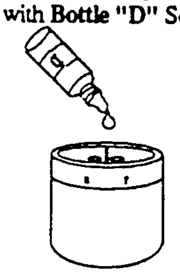


**Step 3:** Let stand **2 minutes**. The solution in the two vials will not dissolve completely. It will remain hazy.

**Step 4:** Pour contents of TNT Vial onto the T side of the cup assembly. Repeat for the RDX Vial using the R side of the cup assembly. **Let Liquid drain** completely for both sides.



**Step 5:** Fill to the line on the cup assembly (8 to 10 drops) on both the T and R sides with **Bottle "D"** Solution (yellow cap). **Let drain.**



yellow wash sol'n

**Step 6:** Add 5 drops of the **Bottle "E"** Solution (blue cap) to both sides of the cup assembly, **let drain.**

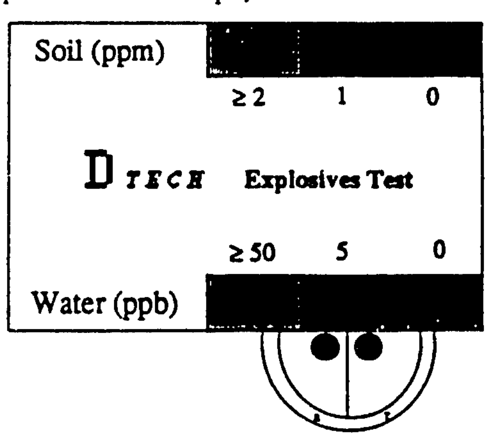
enzyme substrate

**Step 7:** Let stand for **10 minutes** while at 65-78°F. Refer to the temperature range chart.

**Step 8:** Fill to the line on the cup assembly (8 to 10 drops) on both the T and the R sides with **Bottle "F"** Solution (red cap). **Let Drain.**

stop sol'n

**Step 9:** Compare color produced on both the T and the R sides of the cup assembly to the respective sides of the color card (note different color strip for soil or water sample). Record Results.



## PERFORMANCE CHARACTERISTICS

ASSAY RANGE: The DTECH TNT/RDX Explosives test has been determined field dependable for measuring contaminates in the following ranges.

| | Water | Soil |
|---|---|---|
| TNT | | |
| RDX | | |

Sensitivity: This kit has been designed with a working range of 5-40 ppb TNT in water and 110-880 ppb in soils. A broader working range can be achieved by adding a simple dilution step. (e.g., if a sample has a TNT concentration in the 2-8 ppm range, you could process the soil sample using the D TECH™ TNT/RDX Soil extract pac and dilute your sample 1:10. The sample could then be run in the D TECH™ TNT/RDX Test Kit as would a normal soil sample. If the results from the D TECH™ kit show TNT concentrations of 800 ppb, the actual concentration (accounting for the 1:10 dilution) will be 8 ppm. If you add the extra dilution step, keep careful records of the dilution and do not omit any of the steps already incorporated in the kit.

TEMPERATURE: The DTECH TNT/RDX Test Kit is designed to operate at a temperature ranging between 65 and 78°F. The temperature dependent step is the enzyme mediated production of color (step #7). If the test is run at temperatures cooler than 70°F, more time is needed for optimum color production. Conversely, if the test is run at temperatures warmer than 80°F, a shorter incubation period is required for accurate quantitation. When the kit is to be used in a temperature range other than 65-78°F, the chart following should be used to optimize the incubation time.

| Temperature °F | Reaction Time Minutes |
|---|---|
| 40-50 | 50 |
| 50-60 | |
| 65-78 | 10 |
| 80-90 | 08 |
| 90-100 | 06 |

SPECIFICITY: The DTECH TNT/RDX Test Kit antibody has been tested for cross reactivity with a host of TNT and RDX analogues and degradation products. The table below summarizes the cross reactivity data, listing the

| Compound | Crossreactivity TNT | Crossreactivity RDX | TNT $I_{50}$ (ppb) | RDX $I_{50}$ (pp?) |
|---|---|---|---|---|
| 2,4,6-trinitrotoluene (TNT) | + | – | 5 | |
| Hexahydro-1,3,5,trinitro-1,3,5-triazine (RDX) | | + | | |
| 2,4-dinitrotoluene | + | – | 500 | |
| 2,6-dinitrotoluene | – | – | – | |
| 1,3,5-trinitro-benzene | + | – | 100 | |
| Methyl-2,4,6-trinitro phenylnitramine | + | – | 50 | |
| Octahydro-1,3,5,7-tetranitro1,3,5,7-tetrazocine | – | – | – | |
| 2,6-diamino, trotoluene | – | – | – | |
| 2-amino, 4,6-dinitrotoluene | + | – | 50 | |
| 4-amino, 2,6-dinitrotoluene | – | – | – | |
| 2-nitrophenol | – | – | – | |
| 4-nitrophenol | – | – | – | |
| 2,4-dinitrophenol | – | – | – | |

Note: Since the kit will detect varying amounts of TNT degradation products, all samples testing positive for TNT should be confirmed by a more specific method.

# TECH™ TNT/RDX EXPLOSIVES TEST KIT

# TK-1001-1 800-222-0342 INSTRUCTION GUIDE

**GENERAL LIMITED WARRANTY**

All EM SCIENCE products are warranted to meet the specifications set forth on their label only. All other warranties, expressed or implied, including the warranties of MERCHANTABILITY AND FITNESS OF USE, are excluded. Any change or modification of an EM SCIENCE product or of its prescribed procedure for use may adversely affect its stated specification. EM SCIENCE shall not be liable in the event of any such change or modification or for any indirect or consequential damages. All EM SCIENCE products are sold on the condition that they be used and disposed of only within the scope of currently recognized critical standards related to human health and the physical environment. EM SCIENCE warrants its instruments against defects in material and workmanship under the prescribed use and operating conditions, for a period of 18 months from date of delivery. This warranty excludes consumables such as fuses, electrodes and other items of an expendable nature.

Prices and specifications are subject to change without notice. We reserve the right to discontinue items without prior notice.

EM SCIENCE/Strategic Diagnostics, Inc.
480 Democrat Raod
P.O. Box 70
Gibbstown, N.J. 08027
(800) 222-0342

# ESE MASTER QUALITY ASSURANCE PROJECT PLAN FOR ANALYTICAL SERVICES

MASTER QUALITY ASSURANCE PROJECT PLAN

FOR ANALYTICAL SERVICES
PROVIDED TO

UNITED STATES ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY (USATHAMA)

THROUGH VARIOUS CONTRACTS AND SUBCONTRACTS

APPROVALS:

| | |
|---|---|
| Marty Stutz<br>Contractor Officer Representative, USATHAMA | 4 MAR 92<br>Date |
| Hugh S. Prentice<br>Program Manager Analytical Services, ESE, Inc. | 2/28/92<br>Date |
| John J. Mousa, PhD.<br>Manager Analytical Services, ESE, Inc. | 2/28/92<br>Date |
| Charles Manos, PhD.<br>Manager, QA Division, ESE, Inc. | 2/28/92<br>Date |
| Joe Owusu-Yaw<br>Program QA Supervisor, QA Division, ESE, Inc. | 2-28-92<br>Date |

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# TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued, Page 2 of 4)

TABLE OF CONTENTS
(Continued, Page 4 of 4)

Volume I (Continued)

TABLE OF CONTENTS
(Continued, Page 3 of 4)

# 1.0 INTRODUCTION

A Quality Assurance Project Plan (QAPP) is required by the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) and the U.S. Environmental Protection Agency (EPA) for all environmental monitoring and measurement efforts mandated or supported by EPA. The QAPP documents the policies, organization, objectives, functional activities, and procedures for the identification and documentation of the precision, accuracy, completeness, and representativeness of the data produced.

USATHAMA has documented QA requirements for laboratories performing analyses in support of environmental programs (USATHAMA 1985, 2nd ed. and January 1990). The ESE Analytical Services Division performs analytical services for USATHAMA by several contractual avenues: ESE has a prime contract with USATHAMA (Contractor Laboratory Analytical Support Services - CLASS) managed by the Analytical Services Division; ESE has subcontracts with other consulting firms for their prime contracts with USATHAMA (RIFS and ATEPS Contracts); ESE has prime contracts with USATHAMA (RIFS and ATEPS Contracts) and the Analytical Services Division serves as Task Mangers.

Analytical methods and QA/QC requirements are consistent for all USATHAMA work no matter which contractual avenue is used. Therefore the ESE Analytical Services Division and Quality Assurance Division have prepared this Master QA plan to be used as an appendix in support of installation specific USATHAMA project plans. This Master QA plan has been prepared following the organizational guidelines contained in the U.S. Environmental Protection Agency guidelines QAMS - 005/80. Project or installation specific requirements different from the requirements outlined in this Master QA plan will be coordinated with the ESE Analytical Services and QA Divisions. The different requirements will be documented in the appropriate USATHAMA project or installation plans and a copy provided to the ESE Analytical Services and QA Divisions for implementation.

Some appendices of this Master QA plan contain specific protocols unique to the USATHAMA CLASS contract. These specific ESE/USATHAMA protocols are unable to be used for the other contracts because of the contract structure. The objective of USATHAMA CLASS contract and all USATHAMA work is to provide defined analytical services by certified laboratories to meet data quality and schedule requirement for remedial investigation projects, emergency response situations, or other required projects. Since the CLASS contract supplies work through separate delivery orders and the work could go to different laboratories, this Master QA plan has been prepared document procedures so analytical work can be assigned on short notices to approved laboratories and avoid costly delays.

## 1.1 SCOPE OF WORK AND SCHEDULE

It is not always known when CLASS delivery orders or other contract work will be awarded therefore a specific scope of work and schedule cannot be defined in this Master QA Plan. Work scopes are defined in each CLASS delivery order with a tentative schedule, however, schedules are finalized through communications with the USATHAMA Contracting Officer's Representative (COR), ESE Program Manager or Task Manager, and the sampling team. Specific scopes of work and schedules for work performed through the other contracts are defined in the appropriate work plans.

Each CLASS delivery order and other contract effort has similar work components that can be defined and scheduled. This Master QA plan defines the required standard procedures. The work components are:

1. Management and administration,
2. Pre-sampling organization,
3. Defining field groups, preparing sampling kits,
4. Shipment of kits and instructions to field personnel,
5. Communications with field team,
6. Field team communications and delivery of samples to the laboratory,
7. Laboratory communications to USATHAMA COR defining sample receipt,
8. Chemical analysis,
9. Submittal of QC charts to USATHAMA for approval,

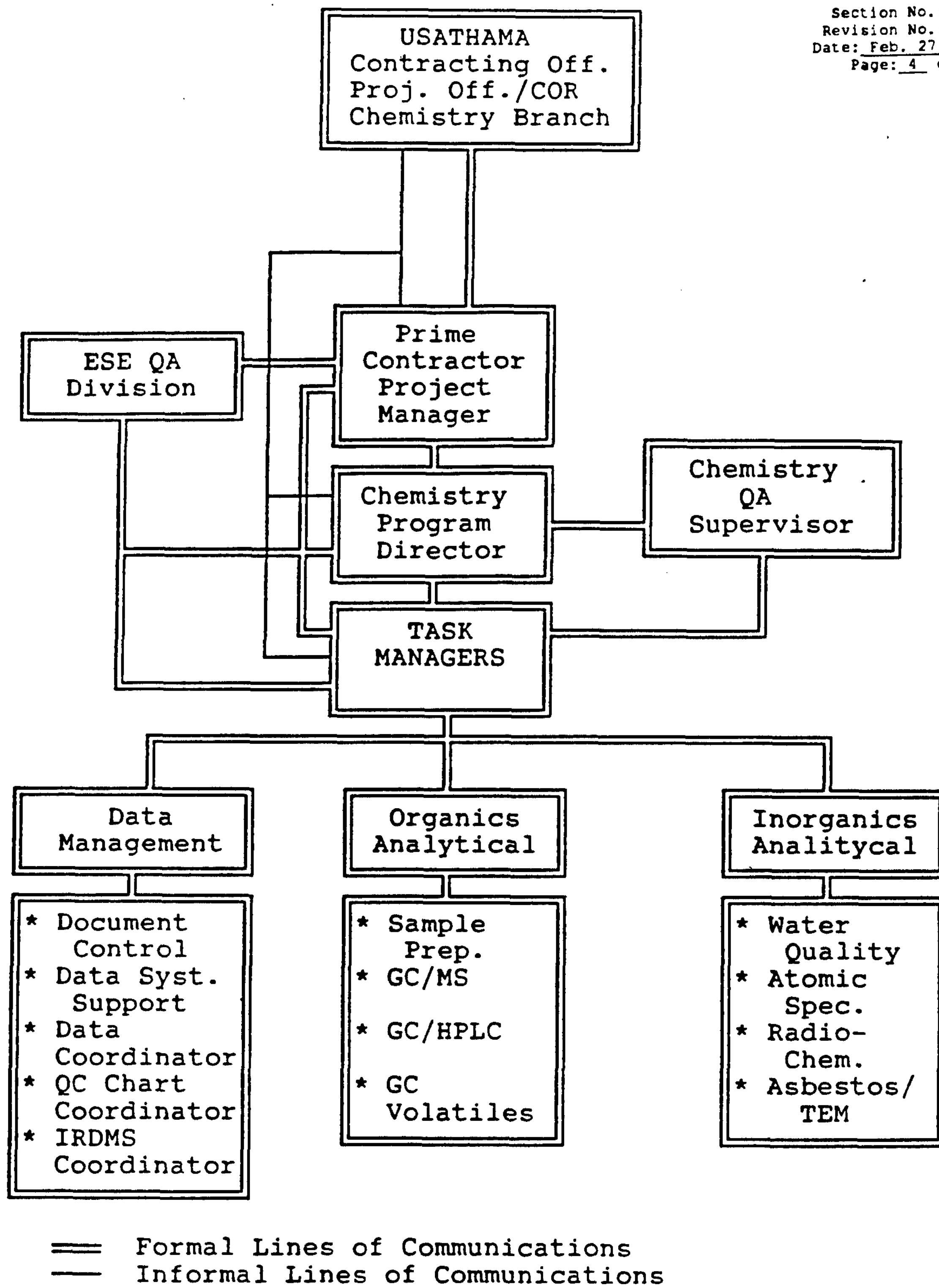
10. Acceptance of charts by USATHAMA or response to comments,
11. Review and validation of chemical analysis
12. Data Management procedures for submitting chemical data to USATHAMA data base,
13. Submission of final files defining work performed for the delivery order or contract effort (Class Order Lot Assignment program - COLA),
14. Preparation and submission of final delivery order reports or project files which include all project related communications, chemical analysis lot folders, data reports, and verification of final USATHAMA data base with what ESE submitted.

## 1.2 SITE DESCRIPTION

Each CLASS delivery order and RATS or ATEPS work order will be site specific. Actual descriptions of the site are not required in this Master QAPP.

## 1.3 PROGRAM ORGANIZATION AND RESPONSIBILITIES

This QAPP functions according to the USATHAMA QA Program. The ESE Analytical Services Division is an approved USATHAMA laboratory monitored by USATHAMA project chemists in the Technical Support Division. The ESE Analytical Services and QA Divisions have organized a program team to support the analytical needs of various USATHAMA contracts. Only key personnel have been identified since some shifting of personnel can occur. The program organization chart is shown in Fig. 1.3-1. The Quality Assurance Division which is independent of the Analytical Services Division has an assigned program team to perform specified duties. The Analytical Services Division has in addition its own QA supervisor. The QA/QC responsibilities of each of the participants are outlined in the following subsections.




Source: ESE, 1990.

Figure 1.3-1 PROGRAM ORGANIZATIONAL CHART

### 1.3.1 ANALYTICAL SERVICES PROGRAM MANAGER

The Analytical Services Program Manager, Mr. Hugh Prentice serves in the QA function as a primary technical reviewer of project deliverables. Responsibilities also include assignment of Task Managers or serving as a Task Manager, review of progress of data deliverables such as QC chart submittals and validation of lot folders, project costs and profitability, review and monitoring of corrective actions, liaison with the USATHAMA CLASS COR and Technology Division Chemists. He works closely with the Data Management Task Manager and support personnel to monitor program progress. The Program Manager also provides authority in support of the Project QA Staff in the performance of his/her duties.

### 1.3.2 PROGRAM QA SUPERVISOR AND QA STAFF

The Program QA Supervisor, Joe Owusu-Yaw, monitors the conduct of all USATHAMA analytical efforts. The Program QA Supervisor is not directly subordinate to anyone responsible for analysis and reports only to the ESE USATHAMA Program Director or the ESE Analytical Services Program Director. The Program QA Supervisor oversees the performance of the QA Staff in the QC chart submittal and lot folder validation process of the ESE laboratory data. The QA Staff (Program QA Supervisor and any QA/QC Coordinator) monitors the chemical analysis effort in the laboratory to ensure compliance with USATHAMA QA requirements and those of this Master QA Plan. The QA Staff does not necessarily audit and monitor field sampling activities for CLASS contract delivery orders, but does for other USATHAMA contracts.

The Program QA Supervisor directly supervises the performance of the QA/QC Coordinator and may audit the performance of any required subcontractor to ensure that the requirements of the QAPP are followed in sampling and analysis activities. The Program QA Supervisor directs the development of the QAPP and approves any deviations or changes to QA/QC requirements. USATHAMA Chemistry Branch and the Contracting Officer's Representative (COR) must approve any changes to the QA/QC program. The project QA Supervisor maintains liaison with the Program Team and the USATHAMA Chemistry Branch.

The Project QA Staff's specific responsibilities are to:

1. Provide an independent overview of the QC practices within each respective organization to ensure that all QC requirements of the QAPP are completed;
2. Maintain and review all QC records, including control charts, and to provide copies of QC records to USATHAMA on a weekly basis;
3. Prepare or review those sections of all interim and final project reports dealing with QC data;
4. Monitor the establishment of testing lots (batches) in coordination with the Analytical Services Program Team and the introduction of appropriate control samples in each lot;
5. Monitor the logging-in of samples, as well as sample preservation, handling, subsampling, and transport throughout the project;
6. Review all data batches for proper QC procedures, audit data files for correct entry of all data, and approve data for transmittal to IRDMS;
7. Monitor the maintenance records on Standard Analytical Reference Materials (SARMs) or interim reference materials;
8. Maintain a vigil of the entire laboratory (and field operations, when applicable) to detect conditions that might jeopardize control of the various analytical and sampling systems;
9. Ensure by field visits, when applicable, that appropriate sampling, field testing, and field analysis procedures are followed and that correct QC checks are being made and
10. Inform the project management concerning non-conformance with the QAPP and provide documentation of said non-conformance, recommend the corrective actions, and document their completion.

### 1.3.3 TASK MANAGER

The Analytical Services Division Task Manager is responsible for effective day-to-day coordination of all analytical activity. He/she is responsible for review and approval of all chemical analysis data generated for the task. The Task Manager's QA/QC responsibilities are to ensure that QC requirements of the QAPP are implemented; provide guidance and technical support in resolution of QC problems (review QC chart corrective actions); support QA/QC preparation of control samples; and provide guidance in preparation of analytical lots to ensure efficient, comprehensive analysis of all required parameters. The Task Manager also provides additional authority, when needed, to support the Project QA Staff in analytical matters and must approve all revisions of the QAPP regarding analytical activities. Several Task Managers are available they are Joe J. Vondrick, Jackie Hargrove, David Greer, Hugh Prentice, and Paul Geiszler.

### 1.3.4 ANALYST SUPERVISORS

Analyst Supervisors are responsible for provision of accurate laboratory data produced by analysts under their supervision. They are responsible for ensuring that all QC procedures are followed and documented. All raw data must be entered into the ESE CLASS system and lot folders must be completed with all the required documentation. The Supervisor or designate must review and ensure that the documentation is complete. The QA/QC role of the Supervisors is to enforce the required QA/QC procedures.

### 1.3.5 ANALYSTS

It is the responsibility of the analysts to perform the required QA/QC procedures and to document all observations and calculations in the proper notebooks or standard forms. At the time analyses are initiated, the analyst defines what samples will be analyzed from the appropriate available numbers system and obtains a lot folder assignment, lot folder forms and recent QC Charts from the Data Management Data Coordinator. ESE field group and sequence numbers are provided so the Data Coordinator can properly update the Chemtrack system to track deadlines.

During analyses the analyst performs preliminary QC checks to determine system performance and control. Recovery data are then submitted to the QC Chart Coordinator for official plotting and submittal to USATHAMA. Analysts must ensure that each batch of data being generated meets all analytical criteria specified by the method. Following completion of the instrumental analyses, the analyst must ensure that the data are entered correctly into the ESE CLASS system and complete all lot folder documentation. The analyst must also bring any unusual observation or analytical problem to the immediate attention of his/her Supervisor, the Program or Task Manager, or the QA Staff. The analyst or field team member must ensure that all instruments are calibrated and the calibration recorded in permanent records. Each analyst is also responsible for ensuring that sufficient quantities of reagents of adequate quality are available for the performance of the required analyses.

### 1.3.6 DATA MANAGEMENT TASK MANAGER

The Analytical Services Division Data Management Task Manager is also in charge of the laboratory information data management system. This computerized data management system, Chemical Laboratory Analysis Scheduling System (CLASS), is described in Appendix E.1. The ESE CLASS system is designed to interact with all USATHAMA program protocols up to submission of data to the IRDMS. Mrs. Virginia O'Brien is the Data Management Task Manager. Her specific duties for the USATHAMA program include supervision of personnel that provide support services for various QA/QC and project management needs. The following support services are performed:

1. Document Control Coordinator - Stores and distributes certified methods and Master QAPP to the appropriate people. He maintains the computerized methods distribution program, and is responsible for reviewing and updating the USATHAMA methods file stored in the ESE CLASS system. The methods file allows automatic production of the correct method information into the IRDMS transfer file.

2. Data Systems Support Coordinator - Enters prefield setup form information into the CLASS system to produce sample labels and chain-of-custody forms. He is responsible for entering completed chain of custody forms to log in samples into the data management system. He also is responsible for filing and storage of validated USATHAMA lot folders until transmittal is required to USATHAMA.
3. Data Coordinator - Assigns lot names and distributes lot folder forms to the analysts requesting a lot assignment. He finalizes data batches and distributes completed lot folders to the appropriate people in the review and validation chain (Analyst, Department Manager, Task Manager, and QA Staff). He also updates the Chemtrak data base which documents the status of QC chart submittals, lot folder review and IRDMS delivery deadlines. He produces weekly reports for the Program Management team to review in weekly management meetings.
4. QC Chart Coordinator - Receives QC spike recovery data from the analysts and produces QC charts. He distributes the charts and corrective action explanations throughout the QC chart review chain (Analyst, Department and Task Manager and QA Staff), and is responsible for documenting and entering status updates for QC charts in the Chemtrak Data base.
5. IRDMS Coordinator - Receives validated lot folders which include files formatted to be read into the IRDMS. He processes the transfer files through the USATHAMA group and record check programs at ESE and then electronically transfers the files to the USATHAMA IRDMS. He is responsible for maintaining documentation on transfers to IRDMS and weekly feedback from the USATHAMA Contractor responsible for the IRDMS system.

# 2.0 QA OBJECTIVES FOR MEASUREMENT OF DATA IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

## 2.1 ANALYTICAL MEASUREMENT DATA

In general all analyses to be performed for CLASS contract Delivery Orders must yield data of a quality sufficient to support human risk assessment. According to EPA Data Quality Objectives Guidance (EPA, 1987), analytical Level 3 or higher will be required. Data quality of a lower analytical level (Level 2) may be requested, an example would be soil gas analyses.

Analyses performed for Delivery Orders will use certified USATHAMA analytical procedures for analysis of water and soil/sediment. These procedures, in many cases, are equivalent to EPA analytical methods. However, some EPA methods do not currently exist for the exotic compound analyses required at various Army Installations (e.g. explosives, agent breakdown products, etc). Comparability of analyses is based on their similarity to EPA methods and review and acceptance of certified methods by USATHAMA (part of USATHAMA certification review process compares data obtained by other labs certifying the same method). Quarterly contractor meetings also review analytical problems, corrective actions and lessons learned from the contractor laboratories.

Data representativeness is defined as the degree to which the sample and results obtained accurately represents the area sampled. Controlling elements are: sampling requirements and protocols; maintenance of sample integrity; and comparability and performance of analytical methods used. Sampling requirements and protocols are not be controlled by the ESE Analytical Services Division, therefore QA objectives can not be defined in this Master QA plan. Maintenance of sample integrity, however, can documented from field sampling to the lab and is controlled within the lab. Prior to lab receipt, representativeness is controlled by providing sampling kits, preservatives and preservation instructions, chain-of-custody forms, and coolers for sample shipment. Sample receipt

by the lab requires verification of proper preservation, documentation, and chain-of-custody. Achievement of analytical extraction and analysis holding times are also required (see Appendix A for summary tables).

Completeness is a measure of the amount of data obtained from a measurement system compared to the amount that was expected under normal conditions. Data completeness required for a certain delivery order is not necessarily known. However, programs in place at USATHAMA which require input from the contractor laboratories (called the COLA program) enables USATHAMA to confirm that all data required by the delivery order have been delivered and elevated to USATHAMA Level III (for definition see USATHAMA QA Program Plan, 2nd Edition, March 1987). USATHAMA approves final delivery order billings by running this final check and thereby ensures completeness. Early identification of incomplete data losses occurs during the weekly control chart review process.

Comparability is the confidence with which one data set can be compared with another. All data will be calculated and reported in units consistent with standard procedures so that the results of the analyses can be compared with those of other laboratories. The objectives of the ESE Analytical Services Division for comparability are:

- to demonstrate traceability of standards to NIST, EPA or USATHAMA sources;
- to report results from similar matrices in standard units;
- to apply appropriate levels of quality control within the context of the laboratory QA program;
- to participate in interlaboratory studies to document laboratory performance.

By using traceable standards and standard methodology, the analytical results can be compared to other laboratories operating similarly.

USATHAMA certification is required to provide initial performance data based on standard matrix control spikes. Daily control spikes are subsequently used to document conformance with certification and to update method precision and accuracy estimates (this is done through a control chart process). Performance data obtained during certification

include: certified reporting limits (CRL's); upper certified limits (UCL's) above which samples require dilution; method precision and accuracy data; and initial control chart limits for the required daily control spike levels. Acceptance criteria for analytical data generated is based on control chart limits which are a measure of laboratory control for that method. Method performance criteria can be used to help judge acceptance of analytical results. Weekly control chart explanations and corrective actions are supplied to USATHAMA for approval.

USATHAMA requires contract laboratories to control the data quality they produce through pre-analysis certification and subsequent daily control spikes which produce precision and accuracy data. Precision and accuracy estimates of the generated data can also be produced by replicate or collocated sampling and matrix spikes, however, these are required on a case-by-case basis and would be either inherent in the sampling design or called for especially in the delivery order.

Precision and accuracy criteria to be used are continually updated by the control chart process. Current control spike limits for the certified methods are presented in Appendix A. Daily control spikes are not performed for every analyte in every method. Selected analytes are spiked for multi-analyte methods for method control purposes. The terms used in Appendix A Tables are briefly explained in the following paragraphs. Items in the table that are not applicable are denoted by NA.

Precision: Evaluated based on the percent difference of duplicate daily standard matrix control spikes (defined in Sec. 11.0).

Accuracy: Evaluated based on the average percent recovery of daily standard matrix control spikes (defined in Sec. 11.0).

Moving Average Precision: Evaluated based on the difference between the highest and lowest recovery of the three recent daily standard matrix control spikes (defined in Sec. 11.0).

Moving Average Accuracy: Evaluated based on the average of individual recoveries of the three recent daily standard matrix control spikes (defined in Sec. 11.0).

Units: Volume in liters (L) [e.g., micrograms per liter (ug/L)] indicates a water matrix. Control spikes are added to organic-free laboratory water. Weight in grams (g) [e.g., micrograms per gram (ug/g)] indicates a soil/sediment matrix. Control spikes are added to a standard USATHAMA soil that has been chemically characterized.

# 3.0 SAMPLING PROCEDURES

This section describes the QC procedures to be followed during environmental matrix sampling for samples received for analysis by USATHAMA CLASS contract delivery orders. To ensure samples representative of the system under study, samples must be collected in properly cleaned containers, promptly and properly preserved, and transported to the laboratory in a manner that minimizes the chance for significant change in constituents. The type of sample (grab, composite, etc.) and the location rationale of the sample point cannot be controlled by this document and should be described in the specific contractor's Sample Design Plan. Proven sampling, preservation, and shipping methods that comply with USATHAMA and EPA specifications will be used. USATHAMA specifications will take precedence over any other specifications unless otherwise required in the delivery order.

The contractor Field Team Leader is responsible for proper sample collection, documentation, preservation, and shipment. The contract laboratory is required to identify documentation, preservation and/or shipment problems to the USATHAMA COR along with recommended actions for guidance concerning stop analysis. The Project QA Staff monitors the receipt of samples and monitors compliance with preservation and holding time specifications.

Typically, a copy of ESE's computerized sample logsheet will accompany the samples as part of the chain-of-custody record (Appendix B). Other chain-of-custody forms may be submitted by the firm doing the field sampling.

The Field Team Leader is responsible for proper sampling, labeling of samples, preservation, and shipment of samples to the laboratory in a proper manner to meet required holding times. Tables in Appendix B identify the preservation methods, holding times, and ESE sampling container and fraction codes that will be used for the analytes. Amber

glass bottles or bottles wrapped to prevent light exposure will be used for all samples to be analyzed for organic species. Plastic containers will be constructed from linear polyethylene. The holding times listed in Appendix B apply to both water and soil/sediment samples.

Appendix B identifies sampling containers and the proper preparation of sampling containers to ensure that all samples properly represent constituents within the environmental matrix sampled. Responsibility for providing the sampling team with properly prepared sampling containers and preservation reagents rests with the ESE Analytical Services Division Task Manager, based on the notification of the sampling schedule by the Field Team Leader and/or ESE Task Manager.

Also presented in Appendix B is an example SOP of communications provided to the sampling team.

The following sections document QC practices related to sampling procedures followed by ESE personnel. This information, which is consistent with the USATHAMA Jan. 1990 QA Program Plan, will be provided to other sampling teams if requested.

## 3.1 VOLATILE COMPOUNDS

Loss of volatile compounds from water samples can occur through headspace and/or evaporation. Care should be taken to preclude aeration of the sample, to completely fill bottles with the samples without any air space, and to analyze within the specified holding times.

Volatile compounds may be analyzed in soil samples, using a solvent extraction step such as methanol extraction or by adding the soil to organic-free water in a sealed purging device. Care must be taken to place samples in an air-tight container immediately upon collection.

## 3.2 GROUNDWATER

Groundwater sampling should not be performed until after newly installed monitor wells have been allowed to reach equilibrium (no less than 14 days after well development). All observations and pertinent data developed during groundwater sampling will be recorded in a field notebook similar to that used for surface water sampling. The following procedures will be followed during sampling:

1. The depth to water will be measured and recorded in the field notebook.
2. Samples will be taken after the fluid in the screen, well casing, and annulus has been exchanged five times. The amount of fluid exchanged will be measured and recorded in the field notebook. All water purged from monitor wells prior to sampling will be collected and transported to the South Balloon Treatment System for treatment. All sampling will be accomplished by a dedicated bailer constructed of polyvinyl chloride (PVC). No glue will be used in the construction of these bailers.
3. To protect the wells from contamination during sampling, the following guidelines will be followed.
   a. A separate bailer (and rope) will be supplied for each well. After use, the bailer will be rinsed with water from the approved source, tagged, wrapped in aluminum foil, and stored in a secure area on-site. Each well will be sampled with a dedicated bailer and, therefore, collection of rinsate for rinsate blank analyses will be unnecessary.
   b. When a pump is used to purge the standing water from the well, the pump, rope, and associated hoses will be thoroughly cleaned between the samples by steam cleaning and allowed to air dry.
   c. All sampling equipment will be placed on disposable polyethylene plastic sheeting spread on the ground at the well to prevent soil contamination of the groundwater samples. Each polyethylene sheet is to be used at only one

well and then appropriately discarded to avoid cross-contamination.

During the sampling of each monitor well, the following data will be collected:

(1) Well number;

(2) Date and Time;

(3) Static water level;

(4) Depth of well;

(5) Pumping rate and duration of pumping, if applicable;

(6) Volume of water removed;

(7) Drawn-down water level;

(8) In situ water quality measurements such as pH, specific conductance, and temperature;

(9) Fractions sampled and preservation;

(10) Miscellaneous observations; and

(11) Signature of sampler and date.

4. The sample will be collected in a manner that will minimize aeration and prevent oxidation of reduced compounds in the sample: well water will not be agitated by the bailer when the bailer is lowered into and out of the monitor well. The sample container will be gently filled to overflowing without air bubbles and tightly capped. For volatiles, the bottles will be checked tc verify that no air has been entrained. If a volatile bottle is contaminated by dropping the septum or touching the septum or lips of the bottle, it will be discarded and a clear bottle issued and labeled. Under no circumstances will volatile fractions be transferred from other sampling containers. Volatile fractions will not be filtered.

5. Samples for metals analyses may or may not be filtered depending on whether dissolved or total metals are required. Samples for total metals analysis will not be filtered. Samples for metal dissolved analyses will be vacuum filtered in the field through a 0.45-micrometer (um) filter, chilled to

4 degrees Celsius ( C), appropriately preserved, and immediately transported to the laboratory.

6. Each sample bottle and cap will be triple rinsed with water from the well at the time of sampling.
7. On-site measurements of water quality will include conductivity, pH, and temperature. Calibration standards will be run prior to each set of measurements. Calibration standards for conductivity will consist of solutions of potassium chloride having conductivities of approximately 1,400, 700, and 150 micromhos per centimeter (umhos/cm). pH buffer solutions at pH 7.0, 10.0, and 4.0 will be used to calibrate pH meters.

## 3.3 SURFACE WATER (IF REQUIRED)

Prior to surface water sampling, the following data will be noted and recorded in the field notebook:

1. Site number or location;
2. Date;
3. Time (24-hour system);
4. Antecedent weather conditions, if known;
5. *In situ* parameter measurements;
6. Fractions and preservatives;
7. Any other pertinent observations (odor, etc.); and
8. Signature of sampler and date.

At the conclusion of each day in the field, the Field Team Leader will review each page of the notebook for errors and omissions and then date and sign each reviewed page.

All field instrument calibrations will be recorded in a designated portion of the notebook at the time of the calibration. Adverse trends in instrument calibration behavior will be corrected.

A single mid-current sampling point will be used. Sampling will take place at approximately 1/2 to 2/3 of the water depth at its deepest point.

Sampling the edge of the canal from the bank will be avoided, if possible. If unavoidable, sampling will be on the outside of a bend where the current flows along the bank. This will avoid collection of stagnant water of a quality that does not represent that of the main flow. Care will be taken to sample at a point on the canal with complete vertical and lateral mixing. Samples will not be taken immediately below a waste source or tributary, unless there is a specific reason to do so.

In the canal, fractions will be taken as a grab sample. The sample container will be held just beneath the surface of the water and allowed to fill.

Prior to sample collection, each sample bottle will be rinsed with the stream water immediately downstream from the sampling point. Surface water samples generally will not be filtered prior to analysis. The need to filter surface water is a project-specific decision that depends on whether dissolved or total contaminants are of interest. Sample fractions for analysis of volatiles and grease/oil will not be filtered.

## 3.4 SOILS

Appropriate point sampling or compositing techniques will be used to ensure that the sample is representative of the area sampled and the type of information (e.g., depth of contamination) desired. Soil samples will be placed in an amber or foil-wrapped, wide-mouthed glass jar with Teflon®-lined lid. Sampling equipment will be decontaminated by the following method:

1. Brush the equipment to remove gross contamination,
2. Steam clean, and
3. Allow to air dry prior to collecting the next sample.

Sample containers will be labeled with a preprinted label, chilled to 4°C, and shipped under ice in a cooler to the laboratory for analysis. No plastic should be allowed to contact soil samples requiring organic analysis.

Surface soil (upper 2 ft) samples will be collected with a hand piston sampler or other appropriate device.

A drill rig utilizing hollow-stem augers is often used to collect subsurface (0 to 15 ft) soil boring samples at selected on-site locations. The following procedures outline a typical soil boring sampling:

1. Soil sampling intervals will be determined by the data requirements at each site.
2. Auger flights will be advanced only to the top of the soil sampling interval. Steam-cleaned flights will be added as needed during the drilling operation. Sampling will be accomplished using a 140-lb hammer to advance a 2-inch modified California split-spoon sampler through and ahead of an 8-inch hollow-stem flight auger. The number of blows required to advance the sampler through 6-inch depth intervals will be recorded.
3. Split-spoon samplers will be initially rinsed in deionized water, and final rinsed with pressurized steam. The same split-spoon sampler will be used only throughout a composite interval (i.e., to a 4.5-ft depth), after which a clean split-spoon sampler will be used.
4. Liners may be used inside of the sampler to collect the sample. When removed from the split spoon, the sample's physical characteristics will be described (e.g., color, lithology, general appearance, etc.). Visible indication of contamination will be noted at this time. A field organic vapor analysis

will be performed on the exposed ends of the sample at this time and also included into the physical log.

5. After the sample liners are sealed, they will be placed on ice and delivered to the laboratory.
6. Sample control and tracking information will be recorded in bound field logbooks with prenumbered pages and will include the following information: boring number and location, date, drilling equipment, driller's name, sampler's name, method of sampling, and soil sample physical description. If more than one notebook is required, each notebook will reference all other notebooks. Sample containers will be labeled to include boring number, depth interval, date, project name, project number, and sampler's initials.
7. At the completion of sampling a given borehole, remaining drill cuttings and the borehole will be handled/grouted and sealed in accordance with USATHAMA geotechnical requirements.

Observations recorded in the field notebook at time of soil sampling will consist of:

1. Site identification;
2. Description of location, including distance from reference point to sample point;
3. Date;
4. Time (24-hour system);
5. Description of vegetation;
6. Characteristics of soil;
7. Sample number;
8. Fractions and preservations;
9. Other observations; and
10. Signature of sampler and date.

Prior to drilling, and between each boring, the drill rig and downhole flight augers will be steam cleaned at the designated on-site rig decontamination station.

## 3.5 SEDIMENTS (IF REQUIRED)

All sediment samples will be collected with a hand piston sampler or other appropriate device. After sampling, depth of water at each sampling point will be measured and recorded. Sampling equipment will be decontaminated using the same procedure described in Sec. 3.4 (soils).

Sediment samples will be placed in amber glass or foil-wrapped containers with Teflon®-lined lids, shipped under ice, and stored at 4°C.

Observations recorded in the field notebook at time of soil sampling will consist of:

1. Site identification;
2. Description of location, including distance from reference point to sample point;
3. Date;
4. Time (24-hour system);
5. Description of vegetation;
6. Characteristics of soil;
7. Sample number;
8. Fractions and preservations;
9. Other observations; and
10. Signature of sampler and date.

# 4.0 SAMPLE CUSTODY

ESE maintains and documents chain-of-custody as described by the National Enforcement Investigation Center (NEIC) of EPA, which defines sample chain-of-custody as follows:

1. The sample is in your actual possession;
2. The sample is in your view after being in your physical possession;
3. The sample was in your possession, and then you locked or sealed it to prevent tampering; or
4. The sample is in a secure area.

A critical step in the processing of samples involves initial check-in and preparation for analysis. Proper chain-of-custody, efficient processing to meet holding times, and avoidance of cross contamination are vital to the integrity of the final data.

Samples are received by the Chemical Analysis Supervisor or his/her designate. The samples are unpacked, and the logsheets are compared with the contents. Samples are scheduled for processing, and the logsheets are given to the Data Management Coordinator, who activates the sample numbers for analysis. If any sample processing is required, it will take place immediately.

Samples are received and checked into the coldroom as described by ESE Analytical Services Standard Operating Procedure (SOP) 4122-04 and shown in Fig. 4.0-1 (selected relevant SOP's from this manual are included in Appendix A). Only the sample custodian replaces samples to the shelves; all other employees replace samples to the return shelf. The coldroom door is always locked when no one is inside.

Samples are not stored in laboratories, but when samples are in a laboratory awaiting analysis, they will be secured by one of the four ways listed previously.

Each sample or sample fraction removed from the coldroom will be recorded on a check-in/check-out form posted outside the coldroom door. The sample number, date of removal, and the person's initials will be clearly recorded.

Each sample or sample fraction returned to the coldroom will be recorded on the same logsheet. The sample number, date of return, and the person's initials will be clearly recorded. Samples and sample fractions will be returned to the return shelf only.

After the sample extraction is completed, at all times under secure custody as defined previously, the extraction technician completes an Extract Custody Form and then transfers the extracts to the analyst. The analyst then stores the extracts in a secure area and places the Extract Custody Form in the lot folder.

The extracts will be stored at all times in a secure area and will not be discarded until permission is received from the USATHAMA Project Officer.

Sample log-in at the laboratory will be monitored by the Project QA Staff. The Project QA Staff will periodically check the computer logsheet for verification of complete conformance of the log to the sample set and verification of the information contained on the sample labels. Any inconsistencies or unusual circumstances, such as broken or leaking containers, improper preservation, or noncompliance with holding or shipping requirements, will be identified in writing to the Project Manager and the Project QA Staff. Corrective action will be recommended and approved by the Project Manager and the Project QA Staff.

Establishment of USATHAMA lots will be performed by the Information Services Group and monitored by the Project QA Staff. After the samples have been logged into the laboratory sample management system, the analyst will request a lot folder assignment when analysis or extraction begins. A lot is the maximum number of samples, including QC samples,

that can be manually processed through the limiting step of the method during a single time period (not to exceed 1 day, 24 hours, as defined by the process). The samples will be placed into analytical lots based on analysis and sample matrix type. The number of samples per lot will depend on the number of samples that can be conveniently and efficiently analyzed in one 24-hour day. The sample digestion/extraction or instrumental step may be the rate-limiting step. Other factors that should be taken into consideration in establishing lot size include: (1) type and complexity of analysis; (2) sample holding time and (3) time constraints imposed by well development, sampling, and shipping. The batch lot will be optimized to provide efficient analysis while meeting the holding time criteria for the samples.

Every attempt will be made to maximize the number of samples per lot within the constraints of the daily rate-limiting step. Small lot sizes may be necessary due to the limited number of samples being collected at any particular installation, especially complex sample analysis or extraction procedures, or holding time constraints.

The following QA procedures will be implemented to monitor sample management and handling:

1. The Project QA Staff will ensure that samples are being labeled, preserved, stored, and transported according to the prescribed methods.
2. The Project QA Staff will monitor the introduction of control samples (spikes and blanks) into the sample flow.
3. The Project QA Staff will prepare, review and comment on control chart explanations, corrective actions, submittals, and evaluate responses and required action by USATHAMA responses.

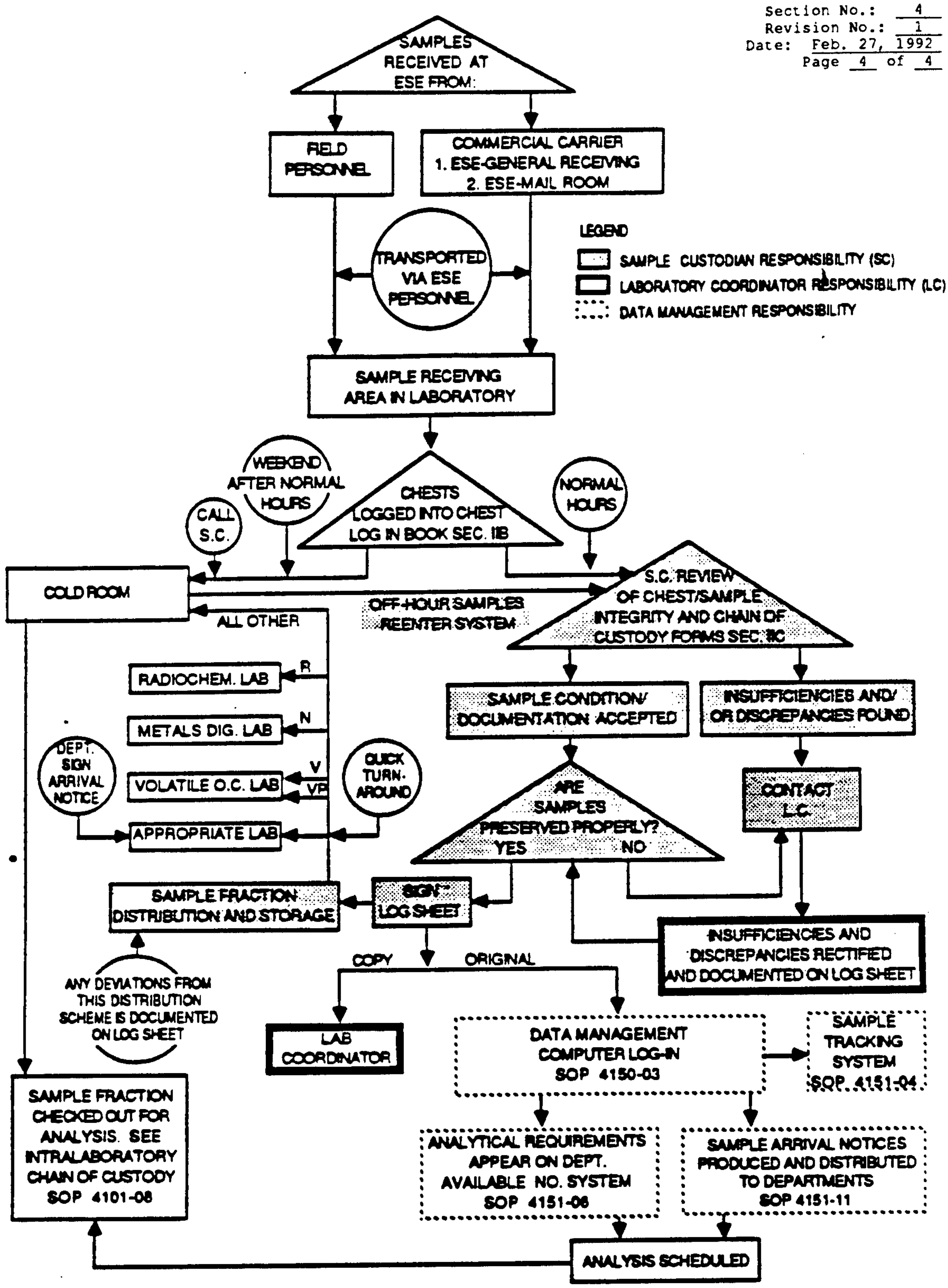



Fig. 4.0-1
**SAMPLE RECEIPT, LOG-IN, AND DISTRIBUTION FLOW CHART (SOP #4122-04)**

SOURCE: ESE, 1987.

**ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.**

# 5.0 CALIBRATION PROCEDURES

Every analytical method performed has been certified by USATHAMA procedures and/or is comparable to EPA approved or other validated, standard method. USATHAMA certified method writeups document the required initial and daily calibration requirements and QC checks for reference samples and continuing calibration checks. Standard reference material are obtained from USATHAMA (SARMS) and EPA. Additional reference materials are obtained commercially. USATHAMA methods require three independently prepared stock solutions from different sources to prepare: calibration standard stock solutions, control spike stock solutions, and reference sample stock solutions.

In general, acceptance criteria for calibration measurements are as follows:

1. Initial calibration curves encompass the upper and lower certified range of the analyte for that method. Curve diagnostics should be consistent with certification requirements (quadratic or linear) and calibration performance will be estimated using Lack-of-Fit.
2. Reference solution analyses must be performed at the time of initial calibration and results must be within criteria of originator or initial limits required by USATHAMA if independent reference solution is not available. Initial acceptance limits are adjusted (tightened) after a specified period of performance using the mean and standard deviation of performance data.
3. Continuing calibration checks are performed at least at the end of a run and recoveries must be within initial defined acceptance limits. Acceptance limits are adjusted (tightened) after a specified period of performance using mean and standard deviation of acceptable performance data.
4. Daily calibration checks can be performed for methods if desired. Daily calibration checks must verify applicability of the initial calibration curve which was confirmed with

reference checks. If daily calibration checks fail the required criteria, an initial calibration curve with reference checks must be performed before analyses are started.

Specific requirements are documented in each certified method and analytical lot folder. Documentation of performance is controlled by the ESE CLASS data management system. Each STORET/Method code combination is updated for the required criteria. Analytical data can not be finalized in the system without an override and an adequately documented explanation if the criteria are not met. Report programs in the CLASS system are in preparation to summarize and include as an Appendix to this Master QAPP all current USATHAMA methods calibration requirements.

Operating procedures are available for all equipment and analytical instrumentation. Such procedures are generally provided by the manufacturer.

Records of instrument calibration procedures amenable to absolute physical and/or electronic calibration performed by the laboratory or by an outside laboratory on a contract basis will be maintained.

Contracts for calibration services should require the contractor to supply records on traceability of calibration standards.

## 5.1 FIELD INSTRUMENTS

Occasionally field instruments will be required for use by laboratory operations personnel.

Instruments used to perform field measurements (e.g., pH, temperature, conductivity, water level) will be calibrated in accordance with procedures outlined in the appropriate operating manual. All equipment will be calibrated daily. Calibration checks will be performed after measurements are taken at each sampling site. All calibration data and calibration checks will be entered into the bound field notebook.

Failure of an instrument to maintain accurate calibration will be reported to the Field Team Leader, who must take immediate corrective action to ensure that accurate field data accompany any samples. The faulty instrument is tagged and cannot be used until repaired and recalibrated.

## 5.2 LABORATORY INSTRUMENTS

Daily QC of the analytical systems ensures that accurate and reproducible results are produced. The analyst must check instrumental calibration data for compliance with QC requirements. Unless specified differently in the approved USATHAMA methods, Table 5.2-1 describes the general instrumental QC checks to be implemented.

Initial calibration should be performed under the following conditions: (1) analysis is first setup or prior to the first set of samples, (2) the instrument has been idle for long periods of time, (3) the instrument detector has been subject to major maintenance, (4) the instrument fails the daily calibration QC checks, or (5) the instrument is used to analyze analytes different from those for which the instrument was calibrated previously.

When available, SARMs supplied by USATHAMA will be used to prepare calibration standards and spiking standards. SARMs or interim SARMs are materials that have undergone extensive purity and stability checks. If SARMs are not available or their quantities limited, "as is" chemicals may be used as interim reference materials. However, the "as is" material would be stored at 0°C and a portion retained for comparison with the approved SARMs when available.

Any "as is" chemical must be characterized for compound identity and purity and results provided to USATHAMA with the certification Performance Data Package. Organic standards will be characterized for purity using capillary gas chromatography/flame ionization detection (GC/FID) analysis and for identity using GC/MS analysis. Inorganic

standards will be identified against known National Bureau of Standards (NBS) or EPA standards.

All reference compounds used in the USATHAMA projects will be stored at 0°C and protected from light. The Project QA Staff will request SARMs as required, monitor their useand maintain a record of receipt of SARMs.

### 5.2.1 DOCUMENTATION OF STANDARD PREPARATION

Standard preparation notebooks are kept to document preparation of independent stock and working solutions for: (1) calibration stock solutions, intermediates, and working solutions; (2) calibration reference working solutions (if reference is a concentrate or reference had to be prepared in the lab); and (3) control spike stock solutions, intermediates, and working solutions. Copies of these notebooks are provided in each analytical lot folder.

### 5.2.2 CALIBRATION CHECKS

Calibration standards are verified with independent reference solutions (when available, otherwise independent stocks solutions are prepared). The analysis of the reference standard is required with each initial calibration. If an initial calibration is run daily, then the reference sample is required on a weekly basis. Reference standards are not required when a daily calibration protocol is followed since the daily calibration standards must be verified to the initial calibration curve. Other calibration quality control involves analysis of continuing calibration check standard (or drift check). Acceptance criteria are documented in each method.

Table 5.2-1. Summary of Instrumental Systems Control Requirements

| Requirement | Analytical Control Limits |
|---|---|
| **Initial Calibration--Minimum Testing Range** | |
| Class 1 | o Calibration curve--concentration series 0X (blank), 0.5X, 1X, 2X, 5X, and *10X, where X is the target or certified reporting limit, as appropriate<br>o *10X daily calibration standard at end of the day<br>o Check standard, *10X, at beginning and end of day |
| Class 1A | o Calibration curve--concentration series 0X (blank), 0.5X, 2X, and *10X<br>o *10X daily calibration standard at end of the day |
| Class 1B | o Calibration curve--concentration series 0X (blank), 0.5X, 2X, and *10X<br>o *10X daily calibration standard at end of the day<br>o Check standard, *10X, at beginning of the day |
| **Daily Calibration--Minimum Testing Range** | |
| Classes 1, 1A, 1B | o *10X daily calibration standard analyzed at beginning and end of the day |

*10X = 10-percent to 25-percent range extension, which allows for fluctuations from a theoretical 100-percent method recovery.

Source: ESE, 1988.

# 6.0 ANALYTICAL PROCEDURES

## 6.1 RATIONALE

Four different levels of method certification (Class 1, 1A, 1B, and 2) are recognized by the December 1985 USATHAMA QA Program Plan (2nd Edition, March 1987). The difference between the classes is the procedure used to characterize laboratory performance of the method. Class 1 certifications are the most rigorous and Class 1 methods will typically be employed in this program. Class 1A certification is reserved exclusively for GC/MS methods, whereas Class 1B is reserved for low sample throughput methods (non-GC/MS). Class 2 certification is used for methods that screen for the presence or absence of contaminants. Each type of analysis requires a different level of documentation, including precision and accuracy data and a different set of daily or batch-related QC criteria. The following sections outline the testing procedures for Classes 1, 1A, and 1B that will be used to define the detection limit, precision, and accuracy of each analytical method. Class 2 will typically not be utilized for this task program.

Method certification in standard media will certify the laboratory to run analyses for a given analyte. Documentation of the analytical testing certification will be submitted to USATHAMA for approval before use of the analytical method for analysis according to the format described in Appendix A of the 1990 USATHAMA QA Program Plan.

ESE's current list of USATHAMA certified methods is provided in a summary table of Appendix A, additional tables in Appendix A list the certified analytes in each method. ESE will prepare from Appendix A, when required, an Appendix to this Master QA Manual that will provide summary descriptions of the USATHAMA methods to be employed for each specific project. In the event that additional methods are needed where no reliable methods exist, documentation for proposed methods development will be submitted to USATHAMA for approval prior to initiation of method development. The documentation package for the

proposed method certification will include a description of the technical approach and an estimate of required resources.

## 6.2 METHOD CERTIFICATION

The following paragraphs describe the procedures to be used to certify analytical methods. All methods certification and documentation data will be developed in standard matrices.

The standard matrix for documentation of inorganic analyses (e.g., sulfate, nitrate, or metals) in water will be deionized water conforming to American Society for Testing and Materials (ASTM) Type I grade water. The standard matrix for documentation of organic analysis will be deionized, organic-free (ASTM Type II) water containing 100 milligrams per liter (mg/L) each of added sulfate and chloride.

The data for documentation of both inorganic and organic analyses in soils and aquatic sediments will be developed using an uncontaminated standard soil matrix obtained from USATHAMA. An aliquot of standard soil will be carried through each set of documentation samples to act as a blank. Added concentrations of the subject analyte(s) will be dissolved in a volume of solvent just sufficient to wet the soil. This solution is poured over the subsample of soil and allowed to stand for 1 hour; volatile organics will be allowed to stand for 15 minutes prior to beginning analysis; the solvent is allowed to evaporate.

If, and only if, a column is to be used for the extraction, the analyte may be dissolved in the minimum quantity of the solvent consistent with volumetric transfer. The solution is placed on the column and allowed to soak in before additional extracting solvent is introduced.

Certain compounds or elements (e.g., nitrate or iron) will be present as natural components of the soil. This background will be accounted for where it exists, and the certified reporting limit (CRL) for the particular method will be considered as the lowest level of analyte in the sample being analyzed which can be quantitatively differentiated

from zero with 90-percent confidence using a complete, specific analytical method and for which precision and accuracy criteria are valid.

### 6.2.1 CLASS 1A GC/MS

The CRL of the total method will be estimated by spiking standard matrices of interest (water, soil, etc.) with the actual analytes and surrogate standards. The spikes must be within the working range of the instrument and in the following minimum sequence: 0 (blank), 0.5X, 2X, and 10X in duplicate, where X is the desired or required CRL. The analyte should be dissolved in a solvent to prepare the spiking solution. The spiked levels should be as close as possible to those listed, but a reasonable attempt at producing these levels will be considered acceptable. The spiked samples will be analyzed through the entire analytical method without dilution for analysis. After analysis, the CRL will be calculated using the USATHAMA reporting limit program. The CRL determined by this process will be reported as the CRL of the method.

In summary, certification of the GC/MS method requires the following:

1. A minimum of two spiked standard matrix samples at each of three concentration levels (0.5X, 2X, and 10X), plus a blank analyzed in a single day;
2. The CRL and accuracy calculated using the USATHAMA reporting limit program; and
3. Documentation of the procedures in USATHAMA format.

### 6.2.2 CLASSES 1 AND 1B NON-GC/MS ANALYSES

Requirements for certification of Classes 1 and 1B methods are as follows:

1. A minimum of one spiked sample at each of five concentration levels (0.5X, X, 2X, 5X, and 10X), plus a blank analyzed each day for 4 separate days. Extended range must include spike samples at 20X, 50X, 100X, 200X, 500X, and 1,000X.

2. The CRL and accuracy will be calculated using the USATHAMA reporting limit program.
3. Documentation of the procedures in USATHAMA format.

### 6.3 PRECERTIFICATION AND CERTIFICATION CALIBRATION CURVES

Before initiating certification activities, a calibration curve will be constructed for the planned analytes at concentrations bracketing the anticipated testing range. The standards will be prepared and analyzed in duplicate. These precertification calibration curves will then be tested for lack of fit (LOF) and zero intercept (ZI) (App. E, 1985 USATHAMA QA Program Plan). The results will then be submitted to USATHAMA Analytical Branch for approval prior to certification initiation.

Decisions will be made as to whether or not the calibration is linear over the range. Those methods with nonlinear calibration curves will be handled on a case-by-case basis with specific controls on daily calibration written into the certified method.

All certification analyses must be preceded by instrument calibration. On the first day of certification analyses, initial calibration will be performed. Initial calibration will consist of a minimum of one blank and five calibration standards that bracket the tested concentration range. The slope of the initial calibration curve is compared to slopes obtained from the precertification calibration curve. All data must be collected during periods when instrument calibration is in control (within 10 percent of the mean response for inorganic analyses and within 25 percent of the mean response for all other analyses).

Separate master stock solutions for calibration and spiking will be utilized for daily control. A single master stock solution for the preparation of calibration standards and control spikes should be utilized only during certification.

## 6.4 CLASS 1 AND CLASS 1B CERTIFICATION

During certification, a minimum of one standard sample at each concentration shall be analyzed each day for 4 separate days. Sample spikes at each concentration for each day shall be prepared from separate master stock solutions as the calibration standards.

The 4 days of analysis shall be consecutive or as close to consecutive as possible. Analysis refers to performance of the entire method, including spiking samples and sample preparation, not merely to instrumental measurement.

The CRL and the method accuracy for each analyte shall be calculated by the Contractor Laboratory using a software program based on the equations outlined in Sec. 11.0. Data generated over the 4 days of analysis shall be used in the calculations.

## 6.5 CLASS 1A CERTIFICATION

During certification, a minimum of two standard samples at each concentration shall be analyzed on a single day. Sample spikes at each concentration for each day shall be prepared from separate master stock solutions as the calibration standards.

Analysis refers to performance of the entire method, including spiking samples and sample preparation, not merely to instrumental measurement.

The CRL and the method accuracy for each analyte shall be calculated by the Contractor Laboratory using a software program based on the equations outlined in Sec. 11.0. Data generated over the single day of analysis shall be used in the calculations.

## 6.6 NON CERTIFIED METHODS

Certification is not required for all analytical methods, for example TOC, TOX, pH, and alkalinity are not considered certifiable by USATHAMA. Certain other methods have not been certified because USATHAMA has not yet officially required certification by ESE.

# 7.0 DATA REDUCTION, VALIDATION, AND REPORTING

## 7.1 INTRODUCTION

There are many steps required to explain data reduction, validation, and reporting for USATHAMA projects. This section provides a summary of operations and procedures with references to the appropriate ESE SOP's for further detail. The ESE CLASS data management system (see Appendix E.1 for system description) is instrumental in ensuring that minimal manual entry errors and manual manipulations occur in providing a client with valid chemical data. USATHAMA requires the production of defined chemical data files and contractor transfer of those files to the USATHAMA IRDMS data base. ESE has a computerized data base that documents the control of data quality. Therefore, programs have been written to automatically produce USATHAMA chemical transfer files to prevent manual entry errors. Validation occurs both internally at ESE and with the USATHAMA IRDMS at each step of the process. As a final check, printouts from the IRDMS are obtained on computer files and verified with the existing ESE data base transferred.

The ESE data management system calculates concentrations and recoveries for all samples and QC from either raw data, manual entry, or computerized transmittal of raw data (i.e. instrument responses for calibration curves, samples and associated QC samples). The data management system allows for control of analytical data for samples by grouping environmental samples in "field groups". Each sample is assigned a defined analyses list or "STORET list" to ensure that all of the required analyses are performed. Each STORET number could have multiple method requirements, therefore "STORET*method code" combinations can be defined in the "STORET list" to control the type and criteria for various QC required. USATHAMA certified method numbers have been used as the "method code" for each STORET required for analysis by that method. The type of QC and required limits are updated and reviewed in each STORET*method code. When EPA STORET numbers are not available or applicable (different units required), ESE internally assigns a STORET number starting with 90000.

Computerized output from the following instruments have been interfaced with the ESE CLASS system to minimize manual entry errors:

1. ICP and furnace instruments for metals analysis;
2. GC/MS instrumentation for VOA and semi-VOA analysis;
3. Ion chromatography instruments and TRACS autoanalyzer instruments; and,
4. Some GC instruments.

All other methods and instrument output require entry of raw data responses or final concentrations and the required QC data. Verified programs in the CLASS system then calculate results for samples and QC and compare them to the required acceptance limits. For the USATHAMA certified methods, specific data entry requirements are documented in individual method summaries which become part of the raw data lot folders.

USATHAMA requires lot name assignments for groups of samples requiring an analysis. The analyst obtains USATHAMA lot name assignments when a "batch" of samples are grouped for analysis or extraction/digestion for analysis. The CLASS system assigns "batch numbers" when analysts begin to enter raw data into the CLASS system. A separate data base has been built relating ESE batch numbers and USATHAMA lot names. This "Chemtrak" data base allows the Chemistry USATHAMA Program Manager and Project Team to monitor the status and priorities for QC chart and lot folder submission and validation.

USATHAMA lot folders constitute the formal documentation for all data reduction, validation, and final report files to the USATHAMA IRDMS. Historically, lot folder documentation requirements have typically called for 'stand alone' documentation and traceability. Currently, method specific requirements are in preparation and incorporation into each certified method. Lot folder document inventory formats including QA validation forms are provided in Appendix D.2. Road maps documenting

comparability to EPA CLP files have been presented in Appendix D.3. Additional data reduction, validation, and reporting information is provided in Appendix E and in the following Sections.

## 7.2 DATA REDUCTION

### 7.2.1 CLASS 1A METHODS (GCMS)

Results will be reported in terms of concentrations in the original matrix and will be reported unadjusted for accuracy for entry into the USATHAMA IRDMS. Results of samples that cannot be diluted within the certified range will be reported as greater than the upper limit of the certified range. Lack of indications of the presence of specific compounds to be reported will be reported as less than the certified reporting limit. Estimates of concentrations of species that have not been subjected to the method certification procedure and for which no standards are available, as in the GC/MS screening procedure, will be reported based on the response compared to the response of a reference compound or internal standard provided that: (1) the instrumental response of the species is at least 10 percent of the response of the internal standard, (2) the estimated concentration contains only one significant figure, (3) the estimated concentration is annotated as based on the reference compound, and (4) the estimated concentration is reported as the concentration in the original matrix assuming 100-percent recovery. Non-target compounds from the GC/MS screen will be reported as the compound in the USATHAMA database or as UNKXXX, where XXX is keyed to the relative retention times.

Results of the analyses will be entered into the USATHAMA IRDMS, as outlined in the Installation Restoration (IR) Data Management User's Guide (USATHAMA, 1988). The analyte concentration will be reported to two significant figures. Results obtained after dilution and results of screening for noncertified analytes will be reported to only one significant figure.

### 7.2.2 CLASSES 1 AND 1B NON-GC/MS

Estimates of concentration levels in QC and actual samples will be reported to USATHAMA according to the guidance as outlined in the

program tasking and the IR Data Management User's Guide. Values less than the CRL will be reported as less than the certified limit.

If results for an analyte were obtained using the method without dilution, the analyte concentration in the sample may be reported up to three significant figures. If dilution is required, the result may be reported to only two significant figures.

The analyst performs the analysis of samples and control samples and plots QC sample results on control charts. The data are then processed through the Data Management System, where automated QC checks are performed, and the data are presented in standard laboratory and USATHAMA format. The Analyst Supervisor then reviews and approves the data. The Task Chemical Analysis Supervisor then reviews and approves the data and QC results and submits the data batch to the Project QA staff for review and approval.

**7.2.3 DOCUMENTATION OF RAW DATA**

The ultimate repository for information concerning analyses performed in the laboratory is the analyst's personal laboratory notebook and the instrument logbooks. Bound notebooks with prenumbered pages are maintained according to good laboratory practices. Entries will be completed in ink. Corrections will be made by drawing one line through the incorrect entry, entering the correct information, and initialling and dating the correction.

Each analyst is required to have a personal notebook designated by a unique number, and is responsible for maintaining complete laboratory notes. The QA/QC Coordinator may audit laboratory notebooks without notice. Method specific forms may be used to document laboratory data.

Laboratory notebooks or forms will not be taken from the laboratory without written permission of the Chemical Analysis Supervisor and the Task Manager. Every entry into the notebook or form should be dated and signed. Entries in the personal notebook or onto the form will vary

depending on the role of the individual in the laboratory and the type of work being performed. At a minimum, the following information should be documented:

1. A reference to or a description of the procedures used for sample workup or analysis,
2. A summary of the samples extracted or analyzed,
3. Weighings and calculations of standard concentrations, and
4. Information on spiking procedures and observations and comments on the procedures or samples.

An instrument logbook will be maintained for required analyses. Each time an instrument is used for sample analysis, the following information is entered:

1. Date of analysis;
2. Project name and number;
3. Type and number of samples analyzed;
4. Time spent on analysis (start to finish);
5. Preventive maintenance performed, if any;
6. Time spent on preventive maintenance;
7. Instrument calibration performed, if any; and
8. Name of analyst.

Additional notes are made in the instrument logs when required. These notes are particularly important when abnormal instrument or analytical performance is observed. It is the analyst's responsibility to ensure that instrument logs are properly filled out and kept up to date. The QA Staff monitors and audits the status of instrument logbooks.

No samples are to be run on any instrument which fails calibration and not until it is clearly demonstrated that the instrument is back in control.

At the end of the project, copies of all logbooks containing information specific to the installation will be forwarded to USATHAMA, if requested. ESE corporate logbooks should be avoided; however, if such

logbooks are used, certified copies of all relevant logbook pages will be submitted to USATHAMA upon request.

## 7.3 DATA VALIDATION PROCEDURES

The data processed through the ESE Data Management system, where automated QC checks are performed, are reviewed by the analyst supervisor, analytical Task Manager, and the QA supervisor. Each data package contains all items documented in Appendix D.2. This includes computerized batch reports, review checklists, and all raw data.

### 7.3.1 LABORATORY LOT FOLDER REVIEW

Once the analyst has completed the analyses for a 'Lot' of samples a USATHAMA Lot Folder is prepared (example in Appendix D.2) and submitted to the data management center. The Data Coordinator finalizes the results in the ESE data batch and incorporates the remaining information into the Lot folder. The laboratory review chain then continues with the Department manager or group leader review of the Lot folder. Finally the Task Manager reviews the Lot prior to QA validation. The Army Data review form (shown in Appendix D.2) is filled out upon completion of review.

### 7.3.2 INDEPENDENT QA AUDIT OF LOT FOLDERS

The Project QA Staff is responsible for audit reviewing for approval all data packets before transmittal of data to USATHAMA for entry into IRDMS. Further, all data packets transmitted to USATHAMA must be validated by the Project QA Supervisor or the QA/QC Coordinator. Validation involves a thorough review of the data documentation from reported results to raw data including recalculation of results of a selected subset of data.

For the efficient flow of laboratory data to USATHAMA, it is critical that the QA and supervisory reviews of data be organized in a planned methodology which includes successful interface with the data management program. Formal review sheets accompany chemical analysis results of each completed lot of samples. The data are routed to several key

individuals for approval. Any changes to the data are documented on the formal review sheets so that the appropriate flags are incorporated in the USATHAMA lot file. Representative examples of these forms are presented in Appendix D.2.

Audits are performed on every data Lot to ensure that all QC checks required by the method were performed and acceptable. The use of method specific data review checklists ensure that a thorough Lot folder audit is done. This audit includes check of the control charts, method blanks, standard matrix recoveries, surrogate recoveries, calibration curves, certified reporting limits and units. Also included in the reviews are analysts's notebook pages, number of samples and identifications, dilutions, moisture content, sample weights, chain-of-custody forms, standard preparation notebooks, instrument logbooks, etc. After ensuring that all these items summaries on the method specific inventory are present and complete, selected data values are verified. Several lines of data in the IRDMS transfer file are selected by a random number generator according to MIL-STD-105D, April 29, 1963. One line of data represents one data point. The chosen data points are then traced back to the raw data to verify correctness.

Any discrepancies pertaining to any of the previously mentioned audits are directed to the analytical task manager for verification, clarification, and/or correction. Other queries regarding the data transmission file are addressed directly to Data management. After these processes are complete the Data Management group can transmit the data to USATHAMA for final group and record checks and entry into IRDMS.

Three data levels are used to indicate increasing QA and validation performed on the data. Data reviewed by ESE and transmitted to USATHAMA IRDMS are considered Level 1. Level 2 data has gone through final checks by PRI (the IRDMS contractor) and USATHAMA. Data are considered Level 3 when approved and transferred to the UNISYS system. Level 3 data are available to users to create reports and graphs, but data cannot be changed by contractors.

**7.4 DATA REPORTING - IRDMS RECORD AND GROUP CHECKS**

After each data packet has been reviewed by key individuals and validated by QA staff, the electronic data file for the packet is loaded into the USATHAMA IRDMS system at ESE and is run through first record check and then group check. Every data point is checked using these two routines. IRDMS record check determines the following:

1. Data correctly formatted.
2. Lab certified for method on date of analysis.
3. Whether file name (such as CGW, CSW) and site type (BORE, WELL) combinations are valid.
4. Sample date, preparation/extraction date and analysis date are compared to determine any holding time violations or inconsistencies.
5. All test names are valid for the method.
6. Value compliance with Certified Reporting Limit and Upper Certified Limit or diluted within range.

IRDMS group check determines the following:

1. The existence of all station identifications for the lot data in the map file for the appropriate installation.
2. That all test names/analytes found in the QC are present in all the samples.
3. That all required QC spikes exist, and that all spiking levels are valid, as determined by the methods table, and that no aberrations exist in QC or sample data.

If any errors are found in group and record check which are not addressed on the lot cover sheet by the laboratory analysts, laboratory project coordinator, or the QA coordinator, the lot is returned to the laboratory project coordinator so that the problem can be rectified. If changes to the analytical data are required, the lot is then resubmitted to Quality Assurance, and after re-validation, it is again processed through IRDMS to assure that any errors have been corrected. Comments affecting the quality of data will be associated with each data point as necessary by the use of flagging codes. A description of these codes

can be found in Appendix E. The flagging code will be placed in Column 29 on the same line as the appropriate test name and data point in the lot file that is submitted to USATHAMA. These codes will be part of the official database.

After the data in a lot have successfully passed QA validation and IRDMS record and group checks, a transfer file of the lot is created and sent to USATHAMA via telephone line. The data are again run through record and group checks by USATHAMA, and after passing the data checks, are elevated to Level 2.

# 8.0 INTERNAL QUALITY CONTROL CHECKS

Several internal QC checks are required by the USATHAMA QA program that the laboratory must perform. Other possible internal QC checks are site specific and are not identified in this Master QA Plan. Site specific internal QC checks that might be defined and required in project specific QA plans are:

1. Collocated, split or replicate samples;
2. Matrix spikes or matrix spike duplicates; and,
3. Frequency of field, trip and equipment blanks.

If the above QC samples are required, decisions on how to implement them occur on a case-by-case basis. Generally, the only impacts are costs because protocols exist to introduce them in the analytical scheme.

Internal QC checks required for USATHAMA work are defined in each individual method write-up. The types of internal QC checks used are:

1. Use of Standard Analytical Reference Material (SARMS) for traceability of independent stock solutions prepared for calibration stocks, control spike stocks and reference solution stocks;
2. Verification of initial calibration curves with independent reference stock solutions;
3. Verification of initial calibration curves with daily calibration standards (if used some methods always use initial calibration);
4. Verification of continued calibration control by analysis of check standards to document calibration drift; and,
5. Analysis of control spikes to document method performance and control in respect to original certification and recent performance.

An attempt will be made to analyze all samples within the certified range of the analytical method. Dilution of a sample extract with extracting solvent or of the original sample matrix with

distilled/deionized water should be performed if the concentration of analyte is greater than the certified range of the method.

## 8.1 SAMPLE PREPARATION

The following paragraphs describe the preparation of water, soil, sediment, and standard samples for analysis. The Project QA Staff will monitor the sample preparation procedure to assure compliance with USATHAMA requirements.

### 8.1.1 WATER SAMPLES

Water samples requiring filtration will be specified in the Project Work Plan. Generally, the filtrate will be analyzed for metals only. An attempt will be made to utilize filtration material that is compatible with the constituents of interest.

If samples containing high levels of contamination are expected, the suspected high-level samples will be filtered last and the suspected low-level samples filtered first to minimize the possibility of cross contamination. Samples for volatiles and oil/grease determination will never be filtered.

### 8.1.2 SOIL/SEDIMENT SAMPLES

Soil and sediment samples will be analyzed in the as-received condition. The soil/sediment samples will be made as homogeneous as possible by shaking and/or stirring with a spatula before a subsample is taken. The sub-sampling procedure does not apply to samples for volatiles analysis.

Percent moisture for soils and sediments will be determined prior to analysis by ASTM Method D2216-17 (ASTM, 1981).

### 8.1.3 STANDARD SAMPLES

Preparation of standard soil and water for methods development and analytical systems control is described in Sec. 6.2. Standard samples for soil analysis consist of samples of an approved uncontaminated soil obtained from USATHAMA.

**8.1.4 METHOD CONTROL QC SAMPLES**

Control samples will be introduced into the train of actual samples as a monitor on the performance of the analytical system. Control samples will consist of spiked standard matrix samples and blanks. Results from spiked standard matrix samples will be used to construct control charts to monitor variations in the precision and accuracy of routine analyses. The specific type and number of control samples and the construction of control charts required for USATHAMA are summarized in Table 8.1-1.

**8.1.4.1 Surrogate QC Spikes**

Certain methods require the use of surrogates to help monitor method performance. When surrogates are required, they are spiked into all environmental samples, QC samples, and method blanks. The surrogates serve two main functions in the GC/MS methods: to control the method and to document the recoveries of compounds similar in chemical composition to the target compounds. The recoveries of the surrogates in the standard matrix spike analyzed with each analytical lot are plotted on $\bar{X}$ and R control charts (control charts are discussed in Sec. 8.1.5.3). If any point on any of the surrogate control charts are outside criteria, either an acceptable explanation must be provided or the analytical lot will have to be reextracted and reanalyzed. Control charts are not prepared for the surrogates in the environmental samples.

The recoveries of the surrogates in the sample matrices are reported to the database and are used to help interpret the analytical results. Typically, if the recoveries of the standard matrix spikes are within precision and accuracy criteria, the method is considered "in control." Sample surrogate recoveries that are much lower or higher than the accuracy or precision criteria typically document that the analytical method is not totally applicable to that sample matrix. For example, if all the acid surrogate recoveries for a sample matrix were below criteria, then the analytical results for the acid extractable target compounds would be interpreted as estimated low due to matrix effects.

Table 8.1-1. QC Requirements by Sample Lot

| Requirement | Analytical Control Limits |
|---|---|
| Control Samples Non-GC/MS Methods | At least one standard matrix method blank for each daily lot. |
| | Three standard matrix control spikes at approximately X, 10X, and 10X, where X is the CRL per daily lot. |
| Control Samples GC/MS Method | At least one standard matrix method blank for each daily lot spiked with deuterated surrogate standards at the 10X level. |
| | Each sample spiked with deuterated surrogate standards spiked at approximately 10X, where X is the concentration in the matrix corresponding to the CRL. |
| Control Charts Non-GC/MS | Plot average percent recovery value ($\bar{X}$) obtained from the duplicate 10X spikes within each lot for the accuracy control chart. |
| | Plot differences (R) between the percent recovery values of the duplicate 10X spikes within each lot for the precision control chart. |
| | Plot 3-point moving average percent recovery values ( X) obtained from the X single spikes within each lot for the moving average accuracy control chart. |

Table 8.1-1. QC Requirements by Sample Lot (Continued, Page 2 of 2)

| Requirement | Analytical Control Limits |
|---|---|
| | Plot 3-point moving differences (R) of percent recovery values of the X single spike within each lot for the moving average precision control chart. |
| Control Charts GC/MS Methods | Plot 3-point moving average percent recovery values ($\bar{\bar{X}}$) obtained from the single 10X standard matrix spike within each lot for the moving average accuracy control chart. |
| | Plot 3-point moving differences (R) of the percent recovery values of the single X spike within each lot for the moving average precision control chart. |

Source: ESE, 1990.

**8.1.5.2 Matrix Spike and Matrix Spike Duplicate QC Samples**

A matrix spike (MS) and matrix spike duplicate (MSD) are not required by USATHAMA but can be requested. If requested, an MS and MSD would be analyzed at a minimum rate of 1 MS and 1 MSD per 20 environmental samples of the same matrix (aqueous versus solid). The MS/MSD would be spiked with the same target compounds that are used to spike the standard matrix. The recoveries of the MS/MSD in the sample matrix could then be reported to the database and are used to help interpret the analytical results. Typically, if the recoveries of the standard matrix spike are within precision and accuracy criteria, the method is considered "in control." Recoveries of target analytes in the MS/MSD that are much higher or lower than the accuracy or precision criteria typically document that the analytical method is not totally applicable to that sample matrix. For example, if the MS/MSD recoveries for a sample matrix were below criteria, then the analytical results for the samples in that batch would be interpreted as estimated low due to matrix effects.

**8.1.5.3 Control Spikes and Charts for GC/MS Methods**

The results of MS and MSD when required, will be reviewed in conjunction with the standard MS, surrogate, and other QC information to aid in determination of the usability of the data. A single control spike of surrogates per lot into standard matrix will be the basis for laboratory control of GC/MS methods. The exact level to be used for the surrogates in the volatiles method and the semi-volatiles method are included in the certified methods writeups and summarized in Appendix A.6. All actual samples will also be spiked with the same surrogate spiking solutions, but the recovery of surrogates from actual samples will not be used for control purposes. The recovery of surrogates from actual samples may be used by USATHAMA at a later time to assess matrix effects.

The percent recovery for each surrogate in the standard matrix spike will be used for control purposes rather than actual concentration. Since there is only one control sample per lot, normal $\bar{X}$ and R (average and range) charts cannot be used. A 3-point moving accuracy and

precision control charting approach will be used. Thus, the required replication is achieved across lots rather than within each lot. During certification, two standard matrix samples are spiked with surrogates at 10X and analyzed on a single day. After one lot has been analyzed, three values will be available: two from certification, and one from the first lot. These three values can then be averaged and the first value of $\bar{X}$ obtained. Similarly, the difference between the highest and lowest will give the first value of R. These values will be the first values plotted on the moving accuracy and precision control charts and will be plotted versus the date of the first actual sample lot analyzed.

Once the second lot is analyzed, a fourth value for percent recovery will be available. This value will be averaged with the values from the second certification value and Lot 1 of actual analysis to obtain the second value for X. The second value for R will be obtained by the difference between the highest and lowest among these three values. These values will then be the second plotted points on the moving average accuracy and precision.

Similarly, after the third lot is analyzed, the percent recovery for this lot is averaged with the individual percent recovery values from the first and second lots to obtain the third value of X; the difference between highest and lowest in this set of three is used to obtain the third plotted point for R. This procedure is continued throughout the project.

After the third point is plotted on the control charts, the analyst will continue calculating the mid-line and control limits and assessing whether laboratory performance is in control. It should be emphasized that the averages plotted on the charts, rather than the individual values, will be used to calculate these limits. The step-by-step procedure for calculating these limits is presented in the 1990 USATHAMA QA Program Plan.

All data will be plotted, whether the lot is in control or not. Each individual value will be tested as an outlier using Dixon's test at the

98-percent confidence limit. If one of the individual points is an outlier, it will not be used in calculating the 3-point moving average but is excluded from the establishment of control limits after 20 in-control data points.

At this point, the control limits should have stabilized and these limits will be used as the basis for determining whether analysis is in control for the next 20 lots. After 40 points are plotted, all 40 values will be used to recalculate the control limits for the next 20 analysis lots. This procedure will be continued for each set of 20 lots. All values will be included in these calculations unless a systematic error was detected for one of the lots that goes into that average value.

#### 8.1.5.4 Control Spikes and Charts for Non-GC/MS Methods

Three spiked standard matrix samples will be included in each lot. The exact levels used for each analyte will be supplied by USATHAMA and included in the certification package. In general, however, each lot will contain two spikes at the 10X level (where X is the CRL obtained during certification), one spike at approximately 2X for that analyte, and one spike at approximately 5X in a natural matrix per analytical lot.

Two different types of control charting approaches will be used for non-GC/MS methods. The first approach will be used for recovery of the 10X spikes where there is replication within each lot. The second approach will be used for the recovery of the 2X spikes and will be similar to the approach used for the GC/MS methods where no within-lot replication was available.

For the recovery of 10X spikes, an average value (X) will be obtained from the duplicate within each lot, and this value will be plotted versus the date for that lot on an accuracy chart. The difference between this replicate will be obtained and plotted on the precision chart versus the date of analysis for that lot.

Initial certification did not use replicate spikes for 10X on each day. Rather, individual percent recovery data are available on each of 4 days. These data will be used as follows to begin control charts. The percent recovery from certification Days 1 and 2 will be averaged to get the first value of the control charts. The percent recovery values for Days 3 and 4 will be used to obtain the second points to be plotted. Percent recovery values, from the first lot of actual samples, will be used to obtain X and R values, and these values will be the third plotted points on the control charts.

After the first actual lot of analysis, control limits will be obtained as described in the 1990 USATHAMA QA Program Plan. These values will be updated after each in-control lot for the first 20 lots.

All recoveries will be plotted, whether or not the lot is in control. Each individual value will be tested as an outlier using Dixon's test at the 98-percent confidence level. If the datum is considered an outlier, it will not be used in calculating the control chart limits after 20 in-control data points.

As described in Sec. 8.1.5.3, these control limits should have stabilized at this point and will serve for control purposes for the next 20 lots. Control limits will then be updated after every 20 lots as described previously.

Control charts for the percent recovery data from the 2X spikes will be handled using the same moving average control charting method described for the GC/MS methods. The only difference will be the manner in which the certification data are used to provide the initial data for the charts.

For these four methods, four individual values for percent recovery were obtained for X during certification. The first 3 days will be used to obtain the initial plotted points for moving accuracy and precision control charts. Days 2, 3, and 4 will be used to obtain the second plotted point for moving accuracy and precision control charts. After

the analysis of the first lot of real samples, the percent recovery for the 2X level spiked sample will be combined with Days 3 and 4 of certification to obtain the third plotted point. Control limits will then be obtained using the step-by-step procedure given in the 1990 USATHAMA QA Program Plan and updated daily until 20 points are plotted. The same approach described previously will be used to update control limits after each new set of 20 lots is analyzed.

In applying the QC requirements presented in Table 8.1-1 to non-GC/MS methods, at least three control samples will be run with each daily lot of samples.

The Project QA Staff may monitor the introduction of the control samples into analytical lot prior to analysis. Subsequent to analysis, the Project QA Staff reviews and approves all control sample data by USATHAMA lots before the results are transmitted to USATHAMA as Level 1 data. Chemical data for each analytical lot which pass QC criteria are automatically entered into the appropriate chemical analysis file for transmission to USATHAMA. The QC results for the QC control samples also are included in the format required by the IR Data Management User's Guide (USATHAMA, 1984).

## 8.2 OUT-OF-CONTROL SITUATIONS

Failure to pass the instrumental calibration or control sample QC criteria or analyzing any sample or sample extract beyond the holding times listed in Table 3.6-1 represents an out-of-control situation and calls for corrective action as required by the USATHAMA QA Plan, which may require rerunning and/or resampling and rerunning the entire lot samples. Written notification of QC failure is provided to the ESE Project Manager, the Chemistry Supervisor, and Project QA Staff.

### 8.2.1 ACCURACY AND PRECISION

An out-of-control situation for accuracy and precision control charts may be indicated by the following:

1. A value falls outside the control limits or is classified as an outlier by the Dixon's test,

2. A series of seven successive values fall on the same side of the central line,
3. A series of five successive values lie in the same direction,
4. A cyclical pattern occurs,
5. Two consecutive points fall between the warning and control limits,
6. Values of greater than or equal to 1/3 of the analytes of a multi-analyte method fall outside the control limits, or
7. Values of analytes of a multi-analyte method fall outside the control limits for two consecutive lots.

### 8.2.2 MOVING ACCURACY AND PRECISION CONTROL CHART CRITERIA

The control and warning limits for the 3-point moving average charts for Class 1 analyses are not intended for method control by themselves but are evaluated in conjunction with results from spikes at the high concentration. Data falling outside control charts limits may indicate quality problems and should be investigated and corrected to achieve the required sensitivity.

# 9.0 PERFORMANCE AND SYSTEM AUDITS

Internal and external systems and performance audits are performed for this program. External audits are primarily performed by the USATHAMA Technical Support Division. These audits include:

1. Semiannual laboratory audit visits;
2. Review and approval of method certification;
3. Review and approval of all QC charts and corrective actions (QC charts are submitted weekly with documented actions required);
4. Review of sample receipt and data submittal status for CLASS contract through COLA program;
5. Review and approval of data files sent to IRDMS; and,
6. Audit of analytical Lot folders submitted by CLASS contract through the final Delivery Order report process.

Protocols for the above audits are not required for this QA Plan but have been presented to provide an overview of the entire process.

Two types of audit procedures will be used to assess and document performance of project staff: system audits and performance audits. These are performed at frequent intervals under the direction of the Project QA Supervisor. These audits form one of the bases for corrective action requirements and constitute a permanent record of the conformance of measurement systems to QA requirements.

System audits are inspections of training status, records, QC data, calibrations, and conformance to standard operating procedures without the analysis of check samples. System audits will be performed periodically on laboratory and office operations.

The internal system audit protocol depends heavily on the Lot folder review process. Every lot of analytical data with supporting information is reviewed sequentially by the analyst, department manager, laboratory coordinator, and QA Supervisor prior to data transmittal to the USATHAMA IRDMS system. Items checked during review are:

a. Copies of parameter and/or laboratory notebooks;

b. Copies of instrument logbooks;

c. Sample log-in, dispensing, and labeling for analysis;

d. Raw data and calculations;

e. Conformance with computer and manual checklists; and,

f. Conformance with document inventory and SOP.

Performance audits will include conductance of field audits and evaluation and analysis of check samples. Field audits will be performed on select projects to assure that sampling procedures are performed according to the QA plan.

ESE will submit to periodic external audits by FDER after notification of and scheduling by the Laboratory Director.

The results of these inter-laboratory studies may be evaluated by the Project QA Supervisor as part of the performance audits.

ESE is participating in the following proficiency programs:

1. National Institute of Occupational Safety and Health (NIOSH) through its Proficiency Analytical Testing Program (PAT),
2. National Institute of Standards and Technology (NIST) proficiency testing program under the National Voluntary Laboratory Accreditation Program (NVLAP) for bulk asbestos,
3. EPA Water Pollution and Water Supply proficiency programs,
4. EPA Radiochemistry Intercomparison Study and Blind Performance Samples,
5. State of New York through its Environmental Laboratory Approval Program (ELAP) for public drinking water and environmental samples categories,
6. State of California Department of Health, and
7. U.S. Corps of Engineers.

The licenses, accreditations, and certifications held by the Gainesville analytical laboratory are the following:

1. American Industrial Hygiene Association (AIHA),

2. National Institute of Standards and Technology for bulk asbestos,
3. State of Florida Department of Health and Rehabilitative Services for environmental and drinking water analysis,
4. New York Department of Health,
5. New Jersey Department of Environmental Protection,
6. South Carolina Department of Health and Environmental Control,
7. EPA CLP--both organics and inorganics,
8. State of Florida Department of Health and Rehabilitative Service for Radiochemistry,
9. State of California Department of Health Services for hazardous waste testing analysis,
10. State of Tennessee Department of Health and Environment for drinking water analysis,
11. U.S. Corps of Engineers, and
12. U.S. Navy.

ESE maintains a compliance program for all toxicity testing and associated chemical and physical analysis performed under the Toxic Substances Control Act and the Federal Insecticide, Fungicide, and Rodenticide Act. Studies are performed as required in full compliance with Good Laboratory Practice (GLP) standards as issued in 40 CFR Part 160 (August 1989) and CFR Part 792 (August 1989). Such studies are routinely audited by the EPA Office of Compliance Monitoring approximately every eighteen months.

The results of these inter-laboratory studies are evaluated periodically by the Project QA Supervisor during the project as part of the performance audits. Results of the internal audits of Lot folders are available for review during the USATHAMA external audits and when delivery order reports are delivered to USATHAMA.

# 10.0 PREVENTATIVE MAINTENANCE

The ESE laboratory in Gainesville, Florida has a Preventive Maintenance SOP (SOP 4101-05) which has been presented in Appendix C along with other pertinent general laboratory operations SOP's. The following sections define routine QC procedures that help define whether current preventive maintenance practices are working or whether special manufacturers visits are required.

## 10.1 METALS SYSTEM CONTROL

### 10.1.1 QC FOR ATOMIC ABSORPTION ANALYSIS

The following routine QC procedures are required for flame and graphite furnace atomic absorption spectrophotometry (AAS) analysis:

1. Instrument calibration is checked using standard solutions. Instrument response is plotted (using a hand calculator) against concentration. The slope is compared to historical slope data to verify that the performance of the instrument is satisfactory. The control charts are kept in the instrument logbook, which also contains a record of routine maintenance and documentation relating to any downtime due to instrument malfunctions. If readings are excessively low, the analyst will check gas flows, burner or cell alignment, wave length, slit width, photomultiplier voltage, and lamp intensity for problems.
2. Blanks and spiked samples are analyzed with each batch of samples.
3. Strip chart recorder tracings for standard solutions, samples, spikes, and duplicates are all stamped for identification and filed in the instrument room.

### 10.1.2 QC FOR INDUCTIVELY COUPLED ARGON PLASMA (ICAP)

Analyses run on the ICAP system require specific instrument calibration and maintenance controls. Routine maintenance on the ICAP system by the manufacturers' representatives is performed on an annual basis. In

addition, a quarterly service contract is maintained on the ICAP system minicomputer.

The analyst will dismantle, clean, and reassemble the torch and nebulizer when response falls below method sensitivity requirements. Calibration with selected standards will be performed daily to ensure that the instrument performance has not deteriorated. The failure to achieve standardization could require cleaning, including changing the tubing of the sample delivery system. Spare parts are available for the system components most likely to experience failure.

Blanks and spiked samples are analyzed with each batch of samples. Hardcopy outputs for standards, samples, and spikes are stamped for identification and filed in the instrument room.

## 10.2 GC ANALYSIS

GC septa will be replaced on a weekly basis or more frequently as needed when symptoms of septum deterioration are noted. Frequent injections will require replacement on a daily basis. When the supply of gas in the cylinders falls below 100 psi, carrier and detector gases will be changed to prevent contaminants from reaching the detector or columns. Molecular sieves and oxygen traps used in the gas lines will be replaced on a regular basis. GC detectors will be removed and cleaned at least periodically to remove accumulations, which can affect instrument performance.

Instrument calibration curves will be monitored and compared to historical performance criteria. Excessive noise, low response, and poor precision are indicators of a dirty detector and may cause more frequent detector cleaning. Spare columns, packing materials, instrument cables, and personal computer (PC) boards will be available in case of breakage or malfunction to minimize instrument downtime.

## 10.3 GC/MS ANALYSIS

Daily instrument control will be practiced to ensure that the instrument is calibrated and in proper working condition. The GC/MS will be tuned, as necesssary, with perfluorotributylamine to calibrate the mass axis and to ensure proper relative abundances. The GC/MS will be tuned and for every 12 hours the instrument is in use with decafluorotriphenylphosphine (DFTPP), these outputs are contained in the data lot folder, for nonvolatiles analysis and bromofluorobenzene (BFB) for volatiles analysis. An instrument tuning log will be maintained to identify any deterioration of instrument performance. The intensity specifications for DFTPP and BFB are contained in Table 10-1. Failure to achieve calibration will require implementation of source cleaning procedures.

In addition, all routine analytical systems controls performed for GC will also be performed for the GC/MS equipment. The ionizing source will be dismantled, thoroughly cleaned, and reassembled when response falls below method sensitivity requirements.

Table 10-1. Mass Intensity Specifications for DFTPP and BFB

| Key Ions | Ion Abundance Criterion |
|---|---|
| For DFTPP* | |
| 51 | 30 to 60 per cent of mass 198 |
| 68 | Less than 2 percent of mass 69 |
| 70 | Less than 2 percent of mass 69 |
| 127 | 40 to 60 percent of mass 198 |
| 197 | Less than 1 percent of mass 198 |
| 198 | Base peak, 100 percent relative abundance |
| 199 | 5 to 9 percent of mass 198 |
| 275 | 10 to 30 percent of mass 198 |
| 365 | Greater than 1 percent of mass 198 |
| 441 | Present but less than mass 443 |
| 442 | Greater than 40 percent of mass 198 |
| 443 | 17 to 23 percent of mass 442 |
| For BFB* | |
| 50 | 15 to 40 percent of mass 95 |
| 75 | 30 to 60 percent of mass 95 |
| 95 | Base peak, 100 percent relative abundance |
| 96 | 5 to 9 percent of mass 95 |
| 173 | Less than 2 percent of mass 174 |
| 174 | Greater than 50 percent of mass 95 |
| 175 | 5 to 9 percent of mass 174 (1 to 12 percent of mass 174)+ |
| 176 | Greater than 95 percent but less than 101 percent of mass 174 |
| 177 | 5 to 9 percent of mass 176 |

*Reference: Test Methods for Evaluating Solid Waste, EPA-SW-846, 3rd Edition, November 1986.
+Variance of 1 to 12 percent of mass 174 for ESE, Gainesville, Fl., GC/MS Instrument D.

Source: ESE, 1989

# 11.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

## 11.1 CERTIFIED REPORTING LIMIT (CRL)

Before any analytical system is employed, sufficient spikes and blanks will be run to statistically establish the lowest sample concentration which may be reported. This concentration is the CRL. CRLs shall be determined by using the USATHAMA program with 90-percent confidence limits. This CRL is associated with the entire method and reflects all sample preparation and measurement steps. First, this approach differs from instrumental detection limit (e.g., three times the blank signal to noise ratio); since the method CRL is typically higher than the instrumental detection limit. Second, because the CRL reflects use of the entire method, all steps of all analyses must always be performed in exactly the same way.

The CRL is derived from the following assumptions:

- The relationship between the found concentration and target concentration is linear;
- The variance about the least squares linear regression line is homogeneous over the tested concentration range; and
- Found concentrations for a given target concentration are normally distributed.

Based on these assumptions, the least squares linear regression line is shown in the following equation:

$$Y = Y_o + bX \qquad (1)$$

where: $Y$ = found concentration,
$Y_o$ = Y axis (found concentration) intercept,
$b$ = slope of the line, and
$X$ = target concentration.

The certification performance data (X, Y paired data) are used to determine the least squares regression line according to the following formula, which assume that errors occur only in the found concentration:

$$\text{slope} = b = \frac{N \sum X_i Y_i - \sum X_i \sum Y_i}{N \sum X_i^2 - (\sum X_i)^2} \tag{2}$$

where: N = number of data points,

$X_i$ = the i-th target concentration, and

$Y_i$ = the i-th found concentration.

$$\text{Y axis intercept} = Y_o = \frac{\sum Y_i - b \sum X_i}{N} \tag{3}$$

where: b = slope of the least squares linear regression line, from Equation 2.

The upper confidence limit about the regression line is given by:

$$Y = Y_o + bX + S_{Y.X}t \left[ 1 + \frac{1}{N} + \frac{(X_i - \bar{X})^2}{\sum (X_i - \bar{X})^2} \right]^{1/2} \tag{4}$$

The lower confidence limit about the regression line is given by:

$$Y = Y_o + bX - S_{Y.X}t \left[ 1 + \frac{1}{N} + \frac{(X_i - \bar{X})^2}{\sum (X_i - \bar{X})^2} \right]^{1/2} \tag{5}$$

where:

$$S_{Y.X} = \left[ \frac{\sum \{Y_i - [\bar{Y} + b(X_i - \bar{X})]\}^2}{N - 2} \right]^{1/2}$$

$Y_o$ = calculated Y axis intercept,

t = student's t for 2-tailed P = 0.10 and N - 2 degrees of freedom,

$\bar{X}$ = the average of all target concentrations, and

$\bar{Y}$ = the average of all found concentrations.

The calculated reporting limit, $X_d$, is the value of X corresponding to a point on the lower confidence limit curve where the value of Y equals the value of Y on the upper confidence limit curve at X = 0.

The calculated reporting limit will be reported as the CRL of the method, provided that at least one of the tested concentrations is at or below the calculated reporting limit. Otherwise, the lowest tested concentration is the minimum level that can be reported as the CRL. The CRL shall not be less than the lowest tested concentration. The CRL for Class 1 and Class 1B is reported to three significant figures. However, the CRL for Class 1A only may be reported to two significant figures.

### 11.2 METHOD CERTIFICATION ACCURACY

The slope, b, of the least squares linear regression line of a plot of found versus target concentration is a measure of the accuracy of the method. A slope (accuracy) of "plus one" (1.00) indicates 100-percent recovery over the complete analytical method and tested range. Failure to consider the intercept, if it is appreciably different from zero, could result in an erroneous estimate of the accuracy. Experimental values may deviate from this expected value. The certification data will provide an optimistic estimate of the method accuracy because interferences found in natural samples will be absent. The accuracy estimate for the complete certification data set is incorporated into the USATHAMA IRDMS. The slope for the complete data set shall be used as the accuracy, even if the CRL was obtained from a truncated data set.

### 11.3 METHOD CERTIFICATION STANDARD DEVIATION

For Class 1, Class 1A, and Class 1B certification, the standard deviation, S, will be calculated at each target concentration according to:

$$\text{standard deviation} = S = \left[ \frac{\Sigma Y_i^2 - \dfrac{(\Sigma Y_i)^2}{N}}{N - 1} \right]^{1/2} \qquad (6)$$

where: $Y_i$ = the found concentration, and
N = total number of Y values at each target concentration.

This calculation is performed by the USATHAMA software.

## 11.4 METHOD CERTIFICATION PERCENT INACCURACY

For Class 1, Class 1A, and Class 1B certification, the percent inaccuracy will be calculated at each target concentration according to:

$$\text{percent inaccuracy} = \frac{Y - X}{X} (100) \tag{7}$$

where: X = target concentration, and
Y = average found concentration at the target concentration.

This calculation is performed by the USATHAMA software.

## 11.5 METHOD CERTIFICATION PERCENT IMPRECISION

For Class 1, Class 1A, and Class 1B certification, the percent imprecision will be calculated at each target concentration according to:

$$\text{percent imprecision} = \frac{S}{Y} (100) \tag{8}$$

where: S = standard deviation, and
Y = average found concentration at the particular target concentration.

This calculation is performed by the USATHAMA software.

## 11.6 DATA ACCURACY AND PRECISION

Accuracy and precision will be assessed using data from the duplicate spiked QC samples in each lot. Percent recovery is calculated as follows:

$$\text{Percent recovery} = \frac{\text{Found Concentration}}{\text{Spiked Concentration}} \times 100$$

Control charts will be maintained for the duplicate spiked QC samples. To prepare control charts, the analyst should have access to the following data:

1. Percent recovery of each analyte in the two high-concentration spiked QC samples (Class 1),
2. Average (X) percent recovery for the two spiked QC samples (Class 1) in each lot, and
3. Difference (R) between the percent recoveries for the two spiked QC samples (Class 1) in each lot.

The initial control chart will be prepared using the 4 days of certification data closest to the spiking concentration used during analyses. The average X (X), average range (R), and control limits for X and R will be updated after each in-control lot for the first 20 lots. Limits established after Lot 20 will be used for the next 20 lots. Control charts will be updated after each 20 lots thereafter using the most recent 40 points. In updating the control charts, the new data must be combined with the individual values of previous average percent recoveries and not the mean of all previous data. Only lots evaluated as in-control are applicable to the 20- and 40-lot requirements for establishing and updating control limits. Out-of-control or outlier points should be plotted; however, such lots are not used in lot number requirements or control limit calculations.

$$\text{Average} = X = \frac{\Sigma X}{K}$$

$$\text{Range} = R = \frac{\Sigma R}{K}$$

where: X = between-group average of the average recovery of the pairs (within group),

X = average within-group recovery for data pairs,

R = within-group difference between recoveries for data pairs, and

K = cumulative number of pairs in the database.

R = range

UWL on Average: $UWL_{X} = X + 1.25\ R$

UCL on Average: $UCL_{X} = X + 1.88\ R$

LWL on Average: $LWL_{X} = X + 1.25\ R$

LCL on Average: $LCL_{X} = X + 1.88\ R$

UWL on Range: $UWL_{R} = 2.511\ R$

UCL on Range: $UCL_{R} = 3.267\ R$

LWL on Range: $LWL_{R} = 0$

LCL on Range: $LCL_{R} = 0$

All recoveries will be plotted, whether or not the lot is in control. Plotted points represent averaged instrument measurements and not the individual measurement values. Each individual measurement value will be tested as an outlier using Dixon's test at the 98-percent confidence level (App. K, 1990 USATHAMA QA Program Plan). If the datum is not classified as an outlier by the test, the point will be included in updating the control chart limits. If the datum is classified as an outlier, it will not be used in updating the control chart limits. Method control will be judged according to the criteria in Sec. 8.0.

After the first 20 in-control sample lots, control limits will be recalculated using only in-control data points. The control limits will then be drawn backward to encompass all previous points. Any points falling outside of the control limits (UCL or LCL) will be dropped and the control limits recalculated using only points between the UCL and

LCL. Charts will then be updated with the newly calculated control limits and all points plotted. Lots associated with points outside of the new control limits may require resampling and/or reanalysis as determined by the USATHAMA Project Officer on a case-by-case basis. These limits will then be used to control analysis of the next 20 lots. The control charts are now the outlier test, although individual measurements continue to be tested as outliers if they appear not to be representative of the data set. Once 60 or more lots are analyzed by a particular method, control limits are recalculated based on the 40 most recent lots, i.e., control limits for the 60th lot are based on Lots 21 through 60 (40-point slide).

## 11.7 DATA MOVING-AVERAGE ACCURACY AND PRECISION

Moving-average control charts will be maintained for each control analyte spiked in the single low-concentration spiked QC sample (Class 1), single high-concentration spiked QC sample (Class 1B), or the surrogate spiked standard matrix sample (Class 1A). The X - R 3-point moving-average control chart will be constructed for each control analyte as follows:

1. Use percent recovery to allow for minor variations in spiking concentration;
2. The first plotted point is the average of the first three recoveries (from certification, at concentrations nearest the spiking level);
3. Subsequent points are obtained by averaging the three most recent individual recovery values (outliers excluded from calculation but not from plot);
4. The range for each point is the difference between the highest and lowest value for each group of three values; and
5. The central line, UWL, UCL, LWL, and LCL for the control charts are calculated using the following formulas:

$$\text{Average} = X = \frac{\Sigma X}{K}$$

$$\text{Range} = R = \frac{\Sigma R}{K}$$

where: X = between-group average of the average recovery of the three points (within group),

X = average within-group recovery for the three points,

R = within-group difference between recoveries for data pairs, and

K = cumulative number of pairs in the database.

R = range

UWL on Average: $UWL_{X} = X + 0.682\ R$

UCL on Average: $UCL_{X} = X + 1.023\ R$

LWL on Average: $LWL_{X} = X + 0.682\ R$

LCL on Average: $LCL_{X} = X + 1.023\ R$

UWL on Range: $UWL_{R} = 2.050\ R$

UCL on Range: $UCL_{R} = 2.575\ R$

LWL on Range: $LWL_{R} = 0$

LCL on Range: $LCL_{R} = 0$

All data will be plotted, whether or not the lot is in control. Plotted points represent averaged instrument measurements and not the individual measurement values. Each individual measurement value will be tested as an outlier using Dixon's test at the 98-percent confidence level (App. K, 1985 USATHAMA QA Program Plan). If the datum is not classified as an outlier by the test, the point will be included in updating the control chart limits. If one of the individual measurements is an outlier, it will not be used in calculating the 3-point moving average for plotting only, but the measurement is then excluded from calculations that are based on the three most recent acceptable individual points and the control chart limits determined accordingly. Method control will be judged according to the criteria in Sec. 8.0.

After the first control chart points, control limits will be recalculated using only in-control data points. Any points falling outside of the control limits (UCL or LCL) will be dropped from the calculations (but left on the charts) and the control limits recalculated using only points between the UCL and LCL. Charts will then be updated with the newly calculated control limits and all points plotted. Lots associated with points outside of the new control limits

may require resampling and/or reanalysis as determined by the USATHAMA Project Officer on a case-by-case basis. These limits will then be used to control analysis of the next 20 lots. The control charts are now the outlier test, although individual measurements continue to be tested as outliers if they appear not to be representative of the data set. A maximum of the 40 most recent lots will be used to recalculate control limits for 60 or more lots (40-point slide).

If values do not meet criteria as specified in Sec. 2.0, results reported in all samples processed as part of the same set must be labeled as suspect, and the sample may need to be repeated. The Project QA Supervisor will be notified and the necessary corrective action implemented.

## 12.0 CORRECTIVE ACTION

Rapid, effective, and thorough means of implementing the correction of QA problems and for noncomplying items, as well as followup reports, are essential to the implementation of a QA program. The two major types of corrective actions, immediate and long term, both require appropriate documentation. Problems requiring immediate resolution such as instrument malfunction or unexpected field conditions are documented fully in field data books or instrument logs and are covered under normal operating procedures for all disciplines.

Corrective action may also be required to correct noncomplying items or systematic errors. Management must apply a systematic corrective action to eliminate such long-term problems. The QA Staff will assist the Chemistry Program Manager in implementing the process of scheduling, performing, documenting, and ensuring the effectiveness of the action. Such action may consist of personnel retraining or removal from a project, reanalysis of questionable data, instrument replacement, or improved sampling procedures. The QA Staff, after consultation with the Chemistry Program Manager, has stop work authority for project activities that are judged out of control and can require resampling or analysis to bring data items into compliance.

### 12.1 PROBLEM IDENTIFICATION

Weekly control chart submissions to the USATHAMA Technical Support Division requires continual monitoring of the analytical processes and identification of any corrective actions. Explanations of out of control situations or trends must be sufficient enough for USATHAMA to accept the analyses performed. Corrective actions are required to ensure that problems are resolved.

Upon notification of a problem or when a potential problem is identified through any auditing procedure, the QA Staff then notifies the Chemistry Program Manager. Together, the Chemistry Program Manager and QA Staff perform a brief, but thorough, investigation of the reported problem

immediately to determine if a corrective action request is required and should be filed.

Review of the Field Trip Plan, for example, may identify a potential problem to which an immediate solution may be applied, thereby alleviating the necessity for a formal corrective action request.

Corrective actions may be initiated for each measurement system (individual disciplines) by Task Managers or other responsible individuals such as the Department Manager. The QA Staff, along with the Program Manager, will be responsible for approving the corrective action in the same manner as if it had been initiated as a project QA function.

## 12.2 FOLLOWUP PROCEDURES

Adequate followup procedures are provided for either type of corrective action since these actions are not considered complete until the problem has been effectively and permanently solved.

An example of a corrective action request form that can be used to document long-term corrective actions is shown in Fig. 12.2-1. The form may be initiated by any individual who observes a problem on a specific noncomplying item. Each form is limited to a single problem. If more than one problem is involved, each problem should be documented on a separate corrective action request form. Copies of the form are given to the responsible administrative personnel and the QA Staff. The Project Director, Project QA Supervisor, and Chemical Analysis Supervisor discuss the problem jointly to:

1. Determine that specific corrective action is needed to eliminate the problem and assign responsibility for investigating, implementing, and documenting the situation;
2. Determine when the system became out of control;
3. Set a time schedule for determining the required action;
4. Assign responsibility and time schedule to implement the required action;

5. Establish desired effectiveness of the corrective action and implement the correction; and
6. Verify and document that the corrective action has eliminated the problem.

Project-specific corrective actions will be documented to the Task Manager. The Project QA Supervisor will assist the Task Manager to define responsibilities for scheduling, performing, documenting, and ensuring the effectiveness of the required actions.

QA may issue a corrective action for circumstances other than audit nonconformances. If, in the opinion of the QA Staff, for example, members of the project team other than the individual disciplines (i.e., project management) have been negligent and/or nonresponsive to information need requests, a need for corrective action may result. As in the case of audit nonconformance, the corrective action is not complete until a satisfactory resolution is achieved.

QUALITY ASSURANCE CORRECTIVE ACTION REQUEST
AND ROUTING FORM

1. Identification of a Problem: CA# ______________

Originator: ______________________________ Date: __________

Nature of Problem: ______________________________________

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

2. Determination of Required Action:

Responsibility Assigned to: __________________ Due Date: ________

Recommended Action: ______________________________________

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

3. Implementation of Required Action:

Responsibility Assigned to: __________________ Due Date: ________

4. Assuring Effectiveness of Action:

Responsibility Assigned to: __________________ Due Date: ________

Procedure to Assure Effectiveness: ___________________________

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

Fig. 12.2-4.
QUALITY ASSURANCE CORRECTIVE ACTION REQUEST AND ROUTING FORM

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## 13.0 QA/QC REPORTS

The QA Staff will be responsible for submitting several QC reports to USATHAMA. The precertification and certification QC checklists (Figs. 13.0-1 and 13.0-2) will be included in the Performance Data Package submitted during Precertification/Certification (Sec. 6.0). The USATHAMA Data Review Checklist (Fig. 7.3-1) and Summary Audit Reports (Sec. 9.0) will be completed and kept on file with the QA Staff for auditing by USATHAMA. All QC charts (Sec. 8.0) will be submitted to the USATHAMA Technology Division with the cover letter copied to the USATHAMA Project Officer approximately 5 working days after analyses for a week are completed. Points that may indicate an out-of-control situation will be evaluated and explained. Any corrective measures will be fully explained and documented in the QC chart submittal. The QC checklist (Fig. 13.0-3) will be included with each control chart submission.

The format and organization of Delivery Order reports are presented in USATHAMA specific SOP's presented in Appendix B

PRECERTIFICATION PERFORMANCE DATA PACKAGE CHECKLIST
(ONE FOR EACH METHOD)

Contract/Task No.____________________ Installation ________________

The following items are included in this Precertification Performance Data Package for ________________________________ in ______________.
Analyte(s) Matrix

☐ Method written up in USATHAMA format.

Calibration:

☐ Calibration data and curves (plot of raw data).

☐ Documentation for Lack of Fit and Zero Intercept Tests.

______________________ _______
Contractor QAC Date

Figure 13.0-1
PRECERTIFICATION PERFORMANCE DATA PACKAGE CHECKLIST

SOURCE: USATHAMA, 1985.

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

# CERTIFICATION PERFORMANCE DATA PACKAGE CHECKLIST
(ONE FOR EACH METHOD)

Contract/Task No.: ____________________ Installation ____________________

The following items are included in this Certification Performance Data Package for ____________________ in ____________________.
Analyte(s) Matrix

☐ Method written up in USATHAMA format.

Calibration:

☐ Calibration curves from days of certification (plot of raw data).

☐ Documentation for Lack of Fit and Zero Intercept Tests.

Certification:

☐ Data summary -- target versus found.

☐ Reporting limit, precision and action calculations.

☐ Reporting limit plot.

☐ Data summary -- statistics.

☐ Lack of Fit and Zero Intercept Tests.

☐ Chromatograms from each of the four days of certification analyses for the highest tested concentration and for the tested concentration closest to calculated reporting limit.

☐ Spectra for all target analytes (if applicable).

☐ Identity and purity determinations for off-the-shelf reference materials, either purchased by the Contractor or supplied by the Central QA Laboratory.

____________________ ____________
Contractor QAC Date

Figure 13.0-2
CERTIFICATION PERFORMANCE DATA PACKAGE CHECKLIST

SOURCE: USATHAMA, 1985.

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

Contract/Task No. ____________ Installation ____________

1. The following items are included in this weekly control chart package covering method(s) ____________.

2. ☐ Summary

3. ☐ $\bar{X}$ - R Control Charts for duplicate, high concentration spiked QA samples, including plotted points for blind performance samples and Outlier Tests.

4. ☐ $\bar{X}$ - R Three-Point Moving Average Control Charts for action level spikes, and Outlier Tests.

5. ☐ Observations on each chart.

   a. ☐ Trend analysis.

   b. ☐ Out-of-control analysis.

   c. ☐ Actions taken.

   d. ☐ Demonstration of resumption of control.

6. ☐ Recommendations

____________ Contractor QAC ____________ Date

Figure 13.0-3
CONTROL CHART CHECKLIST

SOURCE: USATHAMA. 1985.

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

14. Quality

ESE has always been a leader in providing quality analytical services. To keep with this tradition ESE has initiated a corporate quality improvement program. A copy of ESE's Quality Vision and Policy statements have been included. In a addition of copy of ESE's USATHAMA Master QA Plan has been included.

## ENVIRONMENTAL SCIENCE & ENGINEERING, INC.

### QUALITY VISION

Environmental Science & Engineering, Inc. must always represent excellence in service and expertise to our clients, our vendors and ourselves. We will achieve world-class leadership in our industry and maintain the leading edge by consistently providing quality products and services, and by constantly increasing their value to our clients. To accomplish these goals we must continuously define the requirements of our job, develop our human and capital resources, improve our operating systems, encourage innovative thinking, and conduct our business using state-of-the-art methods.

ENVIRONMENTAL SCIENCE & ENGINEERING, INC.

**QUALITY POLICY**

Environmental Science & Engineering, Inc. provides services and products to our clients and associates that conform to all established requirements, including schedule and budget.

Each employee strives to perform each assignment correctly, the first time. We never compromise on quality and never forget our obligations to our clients.

ESE employees maintain a reputation with our clients, associates, subcontractors and suppliers that is synonymous with quality through a complete understanding of job requirements and consistent performance.

ENVIRONMENTAL SCIENCE & ENGINEERING, INC.

**QUALITY MANAGEMENT PRINCIPLES**

An organization, like an individual, must build on a foundation of sound principles and paradigms. In making our day-to-day management decisions we must keep the following principles clearly in focus:

1) **Excellence in Service and Expertise**

A reputation for excellence is achieved by consistently meeting or exceeding our client needs and expectations and by adding value to their organization. We must always strive to give more than our client expects, knowing that we will receive more in return. All activities must be focused on adding value to our client's organization, knowing this will add value to our own.

2) **Our Mission is Client Satisfaction**

We must view each interaction with clients and potential clients as an opportunity to fulfill our mission, to better understand the needs and expectations of our customer, to better define our job requirements and to seek new business opportunities. Management must promote the understanding that all employees have a responsibility to develop new client opportunities and enhance client satisfaction.

3) **The 3 R's: Roles, Responsibilities and Requirements**

Everyone is a link in a complex supplier/customer chain. The chain extends internally to all parts of the company and to our external suppliers and customers. In our role as supplier, we must constantly strive to understand our customers needs and expectations, and to translate their needs and expectations, into clearly defined requirements for our job. In our role as customer, we must take responsibility for translating our needs and expectations into clearly defined requirements for our suppliers. Defining requirements is an important part of our job.

4) **Quality is Conformance to Requirements**

Quality is defined as conformance to requirements, but only after needs and expectations are carefully translated into clear requirements.

5) **Value Long-term Relationships**

Quality improvement is an ongoing process requiring continual enhancement of the customer/supplier relationship. These relationships must be established on a foundation of mutual respect, trust and benefit; and can be improved only with time by open and honest communications. Therefore, we must be committed to long-term relationships with our customers, employees and suppliers. We must not compromise long-term relationships for short-term gains.

6) **Creativity + Empowerment = Competitive Advantage**

The ultimate competitive advantage is an environment that fully develops and utilizes the creative energies of all employees, and empowers them to act in a way that moves the company toward its goals. Management's role is to promote this view, to guide the process and to facilitate the development, utilization and empowerment of all employees. Therefore, we must invest in our people at every opportunity and to a greater degree than our competitors. We must always strive to achieve the highest and best use of our human resources.

7) **The Standard for Quality is Zero Defects**

Quality can always be improved, and improvements in quality always increase productivity and profits. Furthermore, technical achievement, cost reductions, operating flexibility and customer service can and must be improved concurrently. Management must promote this understanding and the attitude that the standard of performance for quality is zero defects.

8) **Control the Process, Not the Product**

All work is a process, and the quality of a product or service is ensured by controlling the process--not by inspection of the product. Management must strive to reduce variation in all processes, to prevent non-conformance through planning and design, and to mistake-proof processes whenever possible. Process variation can be reduced by standardizing procedures around the best known method for accomplishing a given task.

9) **Standardization Enhances Innovation**

Standardization is the foundation for continuous improvement and the cornerstone for innovation. The best known methods can always be improved. Innovation challenges the existing standards, and continuous improvement is achieved by constantly revising and upgrading the body of knowledge contained in our standard operating procedures. As procedures are changed, managers must be responsible for documenting the changes, and ensuring that the new standards are institutionalized. In this way, good ideas are preserved against the negative effects of time, and innovative improvements in one area of the company can be leveraged throughout the organization.

10) **Problems are Opportunities**

Managers must manage by careful analysis of data. Problems must be faced in an open and honest way. Realizing that problems often represent opportunities for improvements and that the root cause of poor quality is most often the system and not the employee, managers must focus on the price of non-conformance, process improvement, and permanent solutions to problems.

11) **Respect the Individual**

Respect for the individual, their rights and dignity, must form the basis of all our working relationships. Conflicting ideas are a necessary condition of leading-edge thinking, and ensure continuous improvement of our products and services. Therefore, we must value disagreement in the search for excellence, but always with respect for individual dignity. We must work to enhance communications, keep an open mind, and look for the win-win solution to disagreements.

12) **Think Total Quality Management**

Total Quality Management means applying these principles to everything we do, and integrating the quality improvement process to include our customers and suppliers. Quality is everyone's job, but management's only job. Management must recognize that making quality right makes everything else in the company right.

ENVIRONMENTAL SCIENCE & ENGINEERING, INC.

**QUALITY PLEDGE**

We, the employees of Environmental Science & Engineering, Inc., are dedicated to providing services and products to our clients and associates that conform to established requirements, are delivered on schedule and completed within budget. We must constantly strive to understand fully the requirements of our job and to perform every assignment right the first time. We expect our suppliers and subcontractors to do the same.

## REFERENCES


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# APPENDIX A

## Certified Method Summary Tables

## Table of Contents
### Appendix A

# A.1

# List of Methods and References

LIST OF CLASS METHODS

| ARMY METHOD No. | REFERENCE METHOD No. | METHOD NAME |
|---|---|---|
| AAA9 | | IMPA,MPA, AND FLUOROACETIC ACID IN SOIL BY IC |
| H2 | 420 | TOTAL PHENOLS IN WATER BY COLORIMETRY |
| J2 | 7196 | HEXAVALENT CHROMIUM IN WATER BY COLORIMETRY |
| JB01 | 7471 | MERCURY IN SOIL BY CVAA |
| JD15 | 7740 | SELENIUM IN SOIL BY GFAA |
| JD16 | 7911 | VANADIUM IN SOIL BY GFAA |
| JD17 | 7421 | LEAD IN SOIL BY GFAA |
| JD18 | 7761 | SILVER IN SOIL BY GFAA |
| JD19 | 7060 | ARSENIC IN SOIL BY GFAA |
| JS11 | 6010 | METALS IN SOIL BY ICAP |
| JY02 | | HEXAVALENT CHROMIUM IN SOIL BY COLORIMETRY |
| KF10 | 300.0 | NITRATE/NITRITE IN SOIL BY AUTOANALYZER |
| KF14 | 365.1 | PHOSPHATES IN SOIL BY AUTOANALYZER |
| KT05 | 300.0 | ANIONS IN SOIL BY IC |
| KY01 | 335.2 | CYANIDE IN SOIL BY TECHNICON |
| KY10 | 365.1 | ORTHOPHOSPHORUS IN SOIL BY AUTOANALYZER |
| LF03 | | NITROCELLULOSE IN SOIL BY TECHNICON |
| LH10 | 8080 | ORGANOCHLORINE PESTICIDES IN SOIL BY GC-EC |
| LH11 | 8150 | HERBICIDES IN SOIL BY GC-EC |
| LH16 | 8080 | PCBs IN SOIL BY GC-EC |
| LL03 | | ORGANOSULFUR PESTICIDES IN SOIL BY |
| LM18 | 8270 | EXTRACTABLE ORGANICS IN SOIL BY GC/MS |
| LM19 | 8240 | VOLATILE ORGANICS IN SOIL BY GC/MS |
| LN01 | | NITROSAMINES IN SOIL BY GC |
| LN05 | 8140 | ORGANONITROGEN/ORGANOPHOSPHORUS PESTICIDES IN SOIL |
| LO02 | 8010/8020 | VOLATILE ORGANICS IN SOIL BY GC |
| LW12 | 8090 | NITROAROMATICS IN SOIL BY HPLC |
| LW15 | | NITROGUANIDINE IN SOIL BY HPLC |
| LW18 | | THIODIGLYCOL IN SOIL BY HPLC |
| LW24 | 8040 | PHENOLS IN SOIL |
| SB01 | 245.1 | MERCURY IN WATER BY CVAA |
| SD19 | 200.7 | VANADIUM IN WATER BY GFAA |
| SD20 | 239.2 | LEAD IN WATER BY GFAA |
| SD21 | 270.2 | SELENIUM IN WATER BY GFAA |
| SD22 | 206.2 | ARSENIC IN WATER BY GFAA |
| SD23 | 272.2 | SILVER IN WATER BY GFAA |
| SS10 | 200.7 | METALS IN WATER BY ICAP |
| TF18 | 335.2 | CYANIDE IN WATER |
| TF21 | 365.1 | ORTHOPHOSPHORUS IN WATER BY AUTOANALYZER |
| TF22 | 300.0 | NITRATE/NITRITE IN WATER BY AUTOANALYZER |
| TF25 | 350.1 | AMMONIA IN WATER BY AUTOANALYZER |
| TF26 | 351.2 | TKN IN WATER BY AUTOANALYZER |
| TF27 | 365.1 | TOTAL PHOSPHATE IN WATER BY AUTOANALYZER |
| TT10 | 300.0 | ANIONS IN WATER BY IC |
| TY10 | 376.2 | SULFIDE IN WATER BY AUTOANALYZER |
| UF03 | | NITROCELLULOSE IN WATER BY AUTOANALYZER |
| UH02 | 608 | PCBs IN WATER BY GC |
| UH13 | 608 | ORGANOCHLORINE PESTICIDES IN WATER BY GC |
| UH14 | 615 | HERBICIDES IN WATER BY HPLC |
| UL04 | | ORGANOSULFUR PESTICIDES IN WATER BY GC-FPD |
| UM18 | 625 | EXTRACTABLE ORGANICS IN WATER BY GC/MS |
| UM20 | 624 | VOLATILE ORGANICS IN WATER BY GC/MS |
| UN07 | 622 | ORGANONITROGEN/ORGANOPHOSPHORUS IN WATER |

| | | |
|---|---|---|
| UN08 | 607 | NITROSAMINES IN WATER BY GC |
| UO02 | 601/602 | VOLATILE ORGANICS IN WATER BY GC |
| UT02 | | IMPA,MPA, AND FLUOROACETIC ACID IN WATER BY IC |
| UW14 | 609 | NITROAROMATICS IN WATER BY HPLC |
| UW17 | | NITROGUANIDINE IN WATER BY HPLC |
| UW18 | 3510/8040 | PHENOLS IN WATER BY HPLC |
| UW19 | | PETN/NITROGLYCERIN IN WATER |
| UW22 | | THIODIGLYCOL IN WATER BY HPLC |

# A.2

## Method CRLs, UCRs, and Slopes

# DEFINITIONS FOR ABBREVIATIONS USED IN THE FOLLOWING TABLES

NOTE: ALL CONTROL LIMITS ARE SUBJECT TO CHANGE AS PER THE USATHAMA QA PLAN CONTROL CHART PROTOCOL

| | |
|---|---|
| CRL | CERTIFIED REPORTING LIMIT (microgram per gram) |
| UCR | UPPER CERTIFIED RANGE (micrograms per gram) |
| SLOPE | REPRESENTS AVERAGE ACCURACY OVER THE CERTIFIED RANGE |
| MAA | MOVING AVERAGE ACCURACY (percent recovery) |
| LCL | LOWER CONTROL LIMIT OF THE ACCURACY |
| UCL | UPPER CONTROL LIMIT OF THE ACCURACY |
| MAP | MOVING AVERAGE PRECISION |
| PREC | PRECISION OF THE REPLICATE HIGH SPIKE |
| ACCU | ACCURACY OF THE REPLICATE HIGH SPIKE |

AAA9
IMPA, MPA IN SOIL BY IC

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| FC2A | 97381 | FLUOROACETIC ACID | 2.0 | 40.0 | 0.929 |
| IMPA | 97382 | ISOPROPYLMETHYL PHOSPHONIC ACID | 2.11 | 40.0 | 0.929 |
| MPA | 97383 | METHYLPHOSPHONIC ACID | 2.0 | 40.0 | 0.866 |

No EPA Method Number is available at this time.

H2
PHENOLS IN WATER BY COLORMETRY

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| PHENLC | 32730 | PHENOLS (NON-SPECIFIC) | 7.12 | 50.00 | 0.878 |

There is no EPA Number available for this method.

J2
HEXAVALENT CHROMIUM IN WATER BY TECHNICON

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| CRHEX | 1032 | HEXAVALENT CHROMIUM | 2.5 | 50.00 | 0.994 |

There is no EPA Number available for this method.

HSL METALS IN SOIL

| SHORT NAME | METHOD | STORET | LONG NAME | USATHAMA CRL | USATHAMA UCR | USATHAMA SLOPE | CLP* CRL |
|---|---|---|---|---|---|---|---|
| AL | JS16 | 1108 | ALUMINUM | 2.35 | 50000 | 1.008 | 40 |
| SB | (6010) | 1098 | ANTIMONY | 2.42 | 5000 | 0.878 | 12 |
| BA | | 1008 | BARIUM | 5.18 | 2500 | 0.947 | 40 |
| BE | | 1013 | BERYLLIUM | 0.5 | 1000 | 0.956 | 1 |
| CA | | 917 | CALCIUM | 100.0 | 50000 | 0.965 | 1000 |
| CD | | 1028 | CADMIUM | 0.7 | 1000 | 0.92 | 1 |
| CR | | 99584 | CHROMIUM | 4.05 | 5000 | 0.876 | 2 |
| CO | | 1038 | COBALT | 1.42 | 1000 | 0.906 | 10 |
| CU | | 1043 | COPPER | 0.965 | 2500 | 0.958 | 5 |
| FE | | 1170 | IRON | 3.68 | 50000 | 0.97 | 20 |
| MG | | 924 | MAGNESIUM | 100.0 | 50000 | 0.94 | 1000 |
| MN | | 1053 | MANGANESE | 2.05 | 5000 | 0.899 | 3 |
| NI | | 1068 | NICKEL | 1.71 | 5000 | 0.87 | 8 |
| K | | 938 | POTASSIUM | 100.0 | 50000 | 0.968 | 1000 |
| NA | | 934 | SODIUM | 100.0 | 50000 | 0.972 | 1000 |
| TL | | 34480 | THALLLIUM | 6.623 | 5000 | 0.857 | 2 |
| ZN | | 1093 | ZINC | 8.03 | 5000 | 0.888 | 40 |
| PB | JD17 (7421) | 1052 | LEAD | 0.177 | 10 | 0.890 | 1 |
| AG | JD18 (7761) | 1078 | SILVER | 0.025 | 1.0 | 0.882 | 2 |
| V | JD16 (7911) | 1088 | VANADIUM | 0.775 | 20.0 | 0.833 | 10 |
| AS | JD19 (7060) | 1003 | ARSENIC | 0.250 | 10.0 | 0.842 | 2 |
| SE | JD15 (7740) | 1148 | SELENIUM | 0.25 | 10.0 | 0.757 | 1 |
| HG | JB01 (7471) | 71921 | MERCURY | 0.05 | 1.0 | 1.02 | 0.04 |

* These CRLs have been calculated assuming 100% solids, 1.0 gram solid sample and 200 mL final volume.
Numbers in () are the EPA Method Numbers.

KF10 (353.2)
NITRATE IN SOIL BY TECHNICON

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| NIT | 633 | NITRITE, NITRATE (TOTAL) | 0.60 | 12 | 1.080 |

Number in () is the EPA Method Number.

KT05 (300.0)
ANIONS IN SOIL BY IC

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| BR | 97939 | BROMIDE | 5.0 | 200 | 0.957 |
| CL | 99120 | CHLORIDE | 6.05 | 204 | 0.994 |
| F | 949 | FLUORIDE | 3.62 | 51.2 | 0.871 |
| SO4 | 81612 | SULFATE | 90.4 | 512 | 0.904 |

Number in () is the EPA Method Number.

CYANIDE IN SOIL

| | | | | USATHAMA | | | CLP* |
|---|---|---|---|---|---|---|---|
| SHORT NAME | METHOD | STORET | LONG NAME | CRL | UCR | SLOPE | CRL |
| CYN | KY01 (335.2) | 721 | CYANIDE | 0.92 | 10.0 | 0.924 | 2 |

* This CRL was calculated assuming 100% solids, 1.0 gram solid sample and 200 mL final volume.
Number in () is the EPA Method Number.

LF03
NITROCELLULOSE IN SOIL BY TECHNICON

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| NC | 99809 | NITROCELLULOSE | 10.4 | 125 | 0.533 |

There is no EPA Number available for this method.

PESTICIDES/PCBs IN SOIL

| SHORT NAME | METHOD | STORET | LONG NAME | USATHAMA CRL | USATHAMA UCR | USATHAMA SLOPE | CLP CRDL |
|---|---|---|---|---|---|---|---|
| ABHC | LH10 | 98357 | BHC, A | 0.00907 | 0.027 | 0.919 | 0.008 |
| AENSLF | (8080) | 98366 | ENDOSULFAN, A | 0.00601 | 0.0244 | 1.030 | 0.008 |
| ALDRN | | 98356 | ALDRIN | 0.00729 | 0.0257 | 0.988 | 0.008 |
| BBHC | | 98358 | BHC, B | 0.00257 | 0.0254 | 0.975 | 0.008 |
| BENSLF | | 98367 | ENDOSULFAN, B | 0.00663 | 0.0244 | 1.10 | 0.016 |
| DBHC | | 98359 | BHC, D | 0.00555 | 0.0252 | 1.280 | 0.008 |
| DLDRN | | 98365 | DIELDRIN | 0.00629 | 0.0254 | 1.040 | 0.016 |
| ENDRN | | 98369 | ENDRIN | 0.00657 | 0.0252 | 1.090 | 0.016 |
| ENDRNA | | 98370 | ENDRIN ALDEHYDE | 0.0240 | 0.0302 | 0.871 | -- |
| ESFSO4 | | 98368 | ENDOSULFAN SULFATE | 0.00763 | 0.0286 | 1.060 | 0.016 |
| HPCL | | 98371 | HEPTACHLOR | 0.00618 | 0.0262 | 1.040 | 0.008 |
| HPCLE | | 98372 | HEPTACHLOR EPOXIDE | 0.0062 | 0.026 | 1.404 | 0.008 |
| LIN | | 98360 | LINDANE | 0.00638 | 0.0262 | 1.030 | 0.008 |
| MEXCLR | | 97818 | METHOXYCHLOR | 0.0711 | 0.249 | 1.20 | 0.080 |
| PPDDD | | 98362 | DDD-PP | 0.00826 | 0.0246 | 1.11 | 0.016 |
| PPDDE | | 98363 | DDE-PP | 0.00765 | 0.0286 | 1.060 | 0.016 |
| PPDDT | | 98364 | DDT-PP | 0.00707 | 0.0281 | 1.010 | 0.016 |
| TXPHEN | | 98373 | TOXAPHENE | 0.444 | 1.12 | 1.350 | 0.160 |
| ISODR | | 98649 | ISODRIN | 0.00461 | 0.0412 | 0.941 | -- |
| CLDAN | | 98361 | CHLORDANE+ | 0.0177 | 0.1970 | 0.839 | -- |
| PCB016 | LH16 | 98140 | PCB 1016 | 0.0666 | 0.367 | 1.18 | 0.080 |
| PCB221* | (8080) | 98351 | PCB 1221 | 0.0666 | 0.367 | 1.18 | 0.080 |
| PCB232* | | 98352 | PCB 1232 | 0.0666 | 0.367 | 1.18 | 0.080 |
| PCB242* | | 98353 | PCB 1242 | 0.0804 | 0.407 | 1.06 | 0.160 |
| PCB248* | | 98802 | PCB 1248 | 0.0804 | 0.407 | 1.06 | 0.160 |
| PCB254* | | 98354 | PCB 1254 | 0.0804 | 0.407 | 1.06 | 0.160 |
| PCB260 | | 98139 | PCB 1260 | 0.0804 | 0.407 | 1.06 | 0.160 |
| KEND@ | | | ENDRIN KETONE | | | | 0.016 |

* The detection limits for these analytes are uncertified.
+ The CLP Target Compound List has both alpha, and gamma-Chlordane listed separately, the method above is only certified for total Chlordane.
@ This analyte is done with method LM18 (extractable organics by GC/MS)
Numbers in () are the EPA Method Numbers.

## LH11 (8150)
## HERBICIDES IN SOIL BY GC-EC

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| 245TP | 97483 | SILVEX | 8.5 | 109 | 0.907 |
| 24D | 99239 | 2,4-D | 17.7 | 202 | 1.080 |

Number in () is the EPA Method Number.

## LL03
## ORGANOSULFUR PESTICIDES IN SOIL BY GCFP

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| BTZ | 97302 | BENZOTHIAZOLE | 1.08 | 13.2 | 0.788 |
| CPMS | 98653 | 4-CHLOROPHENYLMETHYL SULFIDE | 1.08 | 21.6 | 0.999 |
| CPMSO | 98654 | 4-CHLOROPHENYLMETHYL SULFOXIDE | 2.25 | 45.0 | 1.02 |
| CPMSO2 | 98703 | 4-CHLOROPHENYLMETHYL SULFONE | 2.37 | 47.4 | 0.790 |
| DITH | 98650 | 1,4-DITHIANE | 1.47 | 11.4 | 0.916 |
| DMDS | 98697 | DIMETHYLSULFIDE | 0.69 | 13.8 | 0.946 |
| OXAT | 98644 | 1,4-OXATHIANE | 0.85 | 17.1 | 0.930 |

There is no EPA Number available for this method.

## LN01
## NITROSAMINES IN SOIL BY GCNP

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| 24DNT | 98575 | 2,4-DINITROTOLUENE | 0.092 | 1.00 | 0.737 |
| 26DNT | 98573 | 2,6-DINITROTOLUENE | 0.055 | 1.00 | 0.736 |
| NB | 99485 | NITROBENZENE | 0.0962 | 5.00 | 0.751 |
| NNDMA | 99486 | N-NITROSODIMETHYLAMINE | 0.108 | 0.50 | 0.330 |
| NNDNPA | 99487 | N-NITROSODIPROPYLAMINE | 0.231 | 1.00 | 0.561 |
| NNDPA | 99488 | N-NITROSODIPHENYLAMINE | 0.163 | 5.00 | 0.938 |

LN05 (8140)
ORGANONITROGEN/ORGANOPHOSPHORUS PESTICIDES IN SOIL BY GCNP

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| ATZ | 98655 | ATRAZINE | 0.25 | 2.00 | 1.12 |
| DDVP | 98646 | VAPONA | 0.452 | 5.00 | 1.02 |
| MLTHN | 98648 | MALATHION | 0.580 | 5.00 | 1.17 |
| PRTHN | 98658 | PARATHION | 0.733 | 5.00 | 1.23 |
| SUPONA | 98656 | SUPONA | 0.25 | 5.00 | 1.28 |

Number in () is the EPA Method Number.

LO02 (8010/8020)
VOLATILE ORGANICS IN SOIL BY GC

| SHORT NAME | | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|---|
| 111TCE | + | 98692 | 1,1,1-TRICHLOROETHANE | 0.04 | 5.0 | 0.988 |
| 112TCE | | 98693 | 1,1,2-TRICHLOROETHANE | 0.081 | 5.0 | 0.957 |
| 11DCE | + | 98789 | 1,1-DICHLOROETHENE | 0.051 | 5.0 | 0.941 |
| 11DCLE | | 98683 | 1,1-DICHLOROETHANE | 0.055 | 5.0 | 0.948 |
| 12DCLE | | 98684 | 1,2-DICHLOROETHANE | 0.071 | 5.0 | 0.902 |
| 12DCLP | | 98790 | 1,2-DICHLOROPROPANE | 0.043 | 5.0 | 1.00 |
| 2CLEVE | | 98796 | 2-CHLOROETHYLVINYL ETHER | 0.075 | 5.0 | 0.799 |
| BRDCLM | | 98783 | BROMODICHLOROMETHANE | 0.047 | 5.0 | 0.921 |
| C13DCP | | 98791 | CIS-1,3-DICHLOROPROPENE | 0.062 | 5.0 | 0.860 |
| C2H3CL | | 98795 | VINYL CHLORIDE | 0.031 | 5.0 | 0.921 |
| C2H5CL | | 98786 | CHLOROETHANE | 0.029 | 5.0 | 0.961 |
| C6H6 | + | 98699 | BENZENE | 0.085 | 5.0 | 0.952 |
| CCL3F | | 98794 | TRICHLOROFLUOROMETHANE | 0.037 | 5.0 | 0.929 |
| CCL4 | | 98680 | CARBON TETRACHLORIDE | 0.044 | 5.0 | 0.965 |
| CH2CL2 | | 98689 | METHYLINE CHLORIDE | 0.083 | 5.0 | 0.956 |
| CH3BR | | 98785 | BROMOMETHANE | 0.031 | 5.0 | 0.899 |
| CH3CL | | 98787 | CHLOROMETHANE | 0.18 | 5.0 | 0.933 |
| CHBR3 | | 98784 | BROMOFORM | 0.031 | 5.0 | 0.856 |
| CHCL3 | + | 98682 | CHLOROFORM | 0.038 | 5.0 | 0.969 |
| CLC6H5 | + | 98681 | CHLOROBENZENE | 0.026 | 5.0 | 0.925 |
| DBRCLM | | 98788 | DIBROMOCHLOROMETHANE | 0.081 | 5.0 | 0.957 |
| ETC6H5 | + | 98688 | ETHYLBENZENE | 0.062 | 5.0 | 1.03 |
| MEC6H5 | + | 98691 | TOLUENE | 0.028 | 5.0 | 0.970 |
| T13DCP | | 98792 | TRANS-1,3-DICHLOROPROPENE | 0.081 | 5.0 | 0.957 |
| TCLEA | | 98793 | 1,1,2,2-TETRACHLOROETHANE | 0.045 | 5.0 | 0.906 |
| TCLEE | + | 98690 | TETRACHLOROETHENE | 0.045 | 5.0 | 0.906 |
| TRCLE | + | 98694 | TRICHLOROETHENE | 0.049 | 5.0 | 0.972 |
| XYLEN | | 97353 | XYLENE | 0.086 | 10 | 1.01 |
| 13DCLB | | 99468 | 1,3-DICHLOROBENZENE | 0.032 | 5.0 | 1.01 |
| 13DMB | | 98799 | 1,3-DIMETHYLBENZENE/ M-XYLENE | 0.056 | 5.0 | 1.01 |
| CCL2F2 | | 97015 | DICHLORODIFLUOROMETHANE | 0.032 | 5.0 | 0.921 |
| CL2BZ | | 98803 | DICHLOROBENZENE | 0.06 | 10 | 0.990 |
| T12DCE | | 98687 | TRANS-1,2-DICHLOROETHYLENE | 0.063 | 5.0 | 0.948 |

| | |
|---|---|
| + | THESE ARE THE CONTROL ANALYTES FOR THIS METHOD |
| CRL | CERTIFIED REPORTING LIMIT IN (micrograms per gram) |
| UCR | UPPER CERTIFIED RANGE IN (micrograms per gram) |
| SLOPE | REPRESENTS AVERAGE ACCURACY OVER THE CERTIFIED RANGE |

The number in () is the EPA Method Number.

## LW12 (8090)
## NITROAROMATICS IN SOIL BY HPLC

| SHORT NAME | LONG NAME | CRL | ACCU UCR | SLOPE |
|---|---|---|---|---|
| 135TNB | 1,3,5-TRINITROBENZENE | 0.488 | 24.4 | 0.991 |
| 13DNB | 1,3-DINITROBENZENE | 0.496 | 24.8 | 0.952 |
| 246TNT | 2,4,6-TRINITROTOLUENE | 0.456 | 22.8 | 1.01 |
| 24DNT | 2,4-DINITRIROLUENE | 0.424 | 21.2 | 0.938 |
| 26DNT | 2,6-DINITROTOLUENE | 0.524 | 26.2 | 0.977 |
| HMX | CYCLOTETRAMETHYLENE TETRANITRAMINE | 0.666 | 33.3 | 1.000 |
| NB | NITROBENZENE | 2.41 | 27.4 | 0.793 |
| NG | NITROGLYCERIN | 4.00 | 200.0 | 0.931 |
| PETN | PETN | 4.00 | 80.0 | 0.969 |
| RDX | CYCLONITE | 0.587 | 21.9 | 0.929 |
| TETRYL | NITRAMINE | 0.731 | 20.2 | 1.130 |

No EPA Method Number is available at this time.

## LW15
## NITROGUANIDINE IN SOIL BY HPLC

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| NG | 9779 | NITROGUANIDINE | 0.475 | 9.5 | 0.901 |

There is no EPA Number available for this method.

## LW18
## THIODIGLYCOL IN SOIL BY HPLC

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| CLC2A | 97285 | CHLOROACETIC ACID | 18.0 | 302 | 0.837 |
| TDGCL | 99798 | THIODIGLYCOL | 3.94 | 102 | 1.07 |

No EPA Method Number is available at this time.

## HSL METALS IN WATER

| SHORT NAME | METHOD | STORET | LONG NAME | USATHAMA CRL | USATHAMA UCR | USATHAMA SLOPE | CLP CRL |
|---|---|---|---|---|---|---|---|
| AL | SS10 | 1105 | ALUMINUM | 141 | 45000 | 0.891 | 200 |
| SB | (200.7) | 1097 | ANTIMONY | 38 | 6000 | 0.844 | 60 |
| BA | | 1007 | BARIUM | 5 | 10000 | 1.08 | 200 |
| BE | | 1012 | BERYLLIUM | 5 | 1000 | 0.893 | 5 |
| CA | | 82032 | CALCIUM | 500.0 | 20000 | 0.974 | 5000 |
| CD | | 1027 | CADMIUM | 4 | 5000 | 1.000 | 5 |
| CR | | 1034 | CHROMIUM | 6 | 5000 | 1.010 | 10 |
| CO | | 1037 | COBALT | 25 | 50000 | 0.879 | 50 |
| CU | | 1042 | COPPER | 8.1 | 10000 | 0.985 | 25 |
| FE | | 1045 | IRON | 42.7 | 500000 | 0.907 | 100 |
| MG | | 82033 | MAGNESIUM | 500 | 20000 | 0.988 | 5000 |
| MN | | 1055 | MANGANESE | 2.75 | 2000 | 0.934 | 15 |
| NI | | 1067 | NICKEL | 34.3 | 15000 | 0.860 | 40 |
| K | | 82034 | POTASSIUM | 375 | 12500 | 0.881 | 5000 |
| NA | | 82035 | SODIUM | 500 | 50000 | 0.954 | 5000 |
| ZN | | 1092 | ZINC | 21.1 | 20000 | 0.949 | 10 |
| PB | SD20 (239.2) | 1051 | LEAD | 1.26 | 100 | 0.922 | 5 |
| AG | SD23 (272.2) | 1077 | SILVER | 0.25 | 10 | 1.06 | 10 |
| V | SD19 (200.7) | 1087 | VANADIUM | 3.82 | 200 | 0.909 | 40 |
| AS | SD22 (206.2) | 1002 | ARSENIC | 2.54 | 100 | 0.938 | 10 |
| SE | SD21 (270.2) | 1147 | SELENIUM | 3.02 | 100 | 0.939 | 5 |
| TL | SD09 (279.2) | 1059 | THALLIUM | 6.99 | 25 | 0.950 | 10 |
| HG | SB01 (245.1) | 71900 | MERCURY | 0.243 | 10 | 1.03 | .2 |

Numbers in () are the EPA method Numbers.

## CYANIDE IN WATER

| SHORT NAME | METHOD | STORET | LONG NAME | USATHAMA CRL | USATHAMA UCR | USATHAMA SLOPE | CLP CRL |
|---|---|---|---|---|---|---|---|
| CYN | TF18 (335.2) | 99315 | CYANIDE | 2.50 | 50.0 | 1.00 | 10 |

Number in () is the EPA Method Number.

## TF22 (353.2)
## NITRATE/NITRITE IN WATER BY TECHNICON

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| NIT | 630 | NITRATE PLUS NITRITE | 10 | 200 | 0.999 |

Number in () is the EPA Method Number.

## TT10 (300.0)
## ANIONS IN WATER BY IC

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| BR | 71870 | BROMIDE | 1000 | 25000 | 1.03 |
| CL | 98555 | CHLORIDE | 2120 | 30000 | 0.911 |
| F | 98556 | FLUORIDE | 1230 | 10000 | 1.03 |
| SO4 | 98581 | SULFATE | 10000 | 600000 | 1.00 |

Number in () is the EPA Method Number.

## UF03
## NITROCELLULOSE IN WATER BY TECHNICON

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| NC | 99574 | NITROCELLULOSE | 553 | 6000 | 0.826 |

There is not an EPA Method Number Available for this method.

PESTICIDES/PCBs IN WATER

| SHORT NAME | METHOD | STORET | LONG NAME | USATHAMA CRL | USATHAMA UCR | USATHAMA SLOPE | CLP CRDL |
|---|---|---|---|---|---|---|---|
| ABHC | UH13 | 39337 | BHC, A | 0.038 | 0.638 | 0.941 | 0.05 |
| AENSLF | (608) | 34361 | ENDOSULFAN, A | 0.022 | 0.575 | 1.020 | 0.05 |
| ALDRN | | 39330 | ALDRIN | 0.092 | 0.606 | 0.756 | 0.05 |
| BBHC | | 39338 | BHC, B | 0.018 | 0.600 | 0.891 | 0.05 |
| BENSLF | | 34356 | ENDOSULFAN, B | 0.013 | 0.575 | 1.060 | 0.10 |
| DBHC | | 34259 | BHC, D | 0.029 | 0.594 | 1.150 | 0.05 |
| DLDRN | | 39380 | DIELDRIN | 0.018 | 0.600 | 1.040 | 0.10 |
| ENDRN | | 39390 | ENDRIN | 0.018 | 0.594 | 1.320 | 0.10 |
| ENDRNA | | 34366 | ENDRIN ALDEHYDE | 0.026 | 0.713 | 1.000 | -- |
| ESFSO4 | | 34351 | ENDOSULFAN SULFATE | 0.079 | 0.675 | 0.961 | 0.10 |
| HPCL | | 39410 | HEPTACHLOR | 0.042 | 0.619 | 0.849 | 0.05 |
| HPCLE | | 39420 | HEPTACHLOR EPOXIDE | 0.024 | 0.613 | 1.010 | 0.05 |
| LIN | | 39782 | LINDANE | 0.051 | 0.619 | 0.964 | 0.05 |
| MEXCLR | | 39480 | METHOXYCHLOR | 0.057 | 1.160 | 1.260 | 0.5 |
| PPDDD | | 39310 | DDD-PP | 0.019 | 0.581 | 1.170 | 0.10 |
| PPDDE | | 39320 | DDE-PP | 0.025 | 0.675 | 0.999 | 0.10 |
| PPDDT | | 39300 | DDT-PP | 0.034 | 0.663 | 0.949 | 0.10 |
| TXPHEN | | 39400 | TOXAPHENE | 1.350 | 11.60 | 1.00 | 1.0 |
| CLDAN | | 39350 | CHLORDANE+ | 0.246 | 5.300 | 0.962 | -- |
| PCB016 | UH02 | 98140 | PCB 1016 | 0.160 | 6.4 | 0.826 | 0.05 |
| PCB221* | (608) | 98351 | PCB 1221 | 0.160 | 6.4 | 0.826 | 0.05 |
| PCB232* | | 98352 | PCB 1232 | 0.160 | 6.4 | 0.826 | 0.05 |
| PCB242* | | 98353 | PCB 1242 | 0.190 | 6.3 | 0.925 | 1.0 |
| PCB248* | | 98802 | PCB 1248 | 0.190 | 6.3 | 0.925 | 1.0 |
| PCB254* | | 98354 | PCB 1254 | 0.190 | 6.3 | 0.925 | 1.0 |
| PCB260 | | 98139 | PCB 1260 | 0.190 | 6.3 | 0.925 | 1.0 |
| KEND@ | | | ENDRIN KETONE | | | | 0.10 |

* The detection limits for these analytes are uncertified.
\+ The CLP Target Compound List has both alpha, and gamma-Chlordane listed separately, the method above is only certified for total Chlordane.
@ This analyte is done with method UM18 (extractable organics by GC/MS)
Numbers in () are the EPA Method Numbers

## UH14 (615)
## HERBICIDES IN WATER BY HPLC

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| 245TP | 39760 | SILVEX | 0.181 | 1.36 | 0.931 |
| 24D | 39730 | 2,4-D | 0.802 | 2.52 | 0.646 |

## UL04
## ORGANOSULFUR PESTICIDES IN WATER BY GCFP

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| BTZ | 81512 | BENZOTHIAZOLE | 2.11 | 42.2 | 0.927 |
| CPMS | 98562 | P-CHLOROPHENYLMETHYL SULFIDE | 1.26 | 25.3 | 0.824 |
| CPMSO | 98561 | P-CHLOROPHENYLMETHYL SULFOXIDE | 4.23 | 106 | 0.743 |
| CPMSO2 | 98560 | P-CHLOROPHENYLMETHYL SULFONE | 4.72 | 106 | 0.866 |
| DITH | 98563 | 1,4-DITHIANE | 1.11 | 22.2 | 0.831 |
| DMDS | 81580 | DMDS | 1.14 | 22.8 | 0.801 |
| OXAT | 98564 | 1,4-OXATHIANE | 1.98 | 39.5 | 0.829 |

There is not a EPA Method Number available for this method.

## UN07 (622)
## ORGANONITROGEN/ORGANOPHOSPHORUS PESTICIDES IN WATER BY GC-NPD

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| DDVP | 99897 | VAPONA | 0.25 | 5.0 | 0.884 |
| ATZ | 39033 | ATRAZINE | 0.512 | 5.0 | 1.04 |
| MLTHN | 39530 | MALATHION | 0.25 | 5.0 | 0.999 |
| PRTHN | 39540 | PARATHION | 0.25 | 5.0 | 0.983 |
| SUPONA | 98632 | SUPONA | 0.25 | 4.7 | 1.00 |

## UN08 (607)
## NITROSAMINES IN WATER BY GC-NPD

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| 24DNT | 34611 | 2,4-DINITROTOLUENE | 0.341 | 5.0 | 0.979 |
| 26DNT | 77541 | 2,6-DINITROTOLUENE | 0.250 | 5.0 | 0.964 |
| NB | 34447 | NITROBENZENE | 0.285 | 5.0 | 1.000 |
| NNDNPA | 34428 | N-NITROSO, DI-N-PROPYLAMINE | 0.294 | 5.0 | 1.030 |
| NNDPA | 34433 | N-NITROSODIPHENYLAMINE | 0.250 | 5.0 | 0.968 |

The number in () is the EPA Method Number.

UO02 (601/602)
VOLATILE ORGANICS IN WATER BY GC

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| 111TCE + | 34506 | 1,1,1-TRICHLOROETHANE | 2.9 | 50 | 1.08 |
| 112TCE | 34511 | 1,1,2-TRICHLOROETHANE | 0.332 | 49 | 1.10 |
| 11DCE + | 34501 | 1,1-DICHLOROETHENE | 0.393 | 51 | 1.06 |
| 11DCLE | 34496 | 1,1-DICHLOROETHANE | 0.334 | 49.5 | 1.03 |
| 12DCLE | 34531 | 1,2-DICHLOROETHANE | 2.95 | 49 | 1.08 |
| 12DCLP | 34541 | 1,2-DICHLOROPROPANE | 3.16 | 49 | 1.09 |
| 2CLEVE | 34576 | 2-CHLOROETHYLVINYL ETHER | 22.1 | 49.5 | 1.11 |
| BRDCLM | 32101 | BROMODICHLOROMETHANE | 3.06 | 50.5 | 1.11 |
| C13DCP | 34704 | CIS-1,3-DICHLOROPROPENE | 3.23 | 48.5 | 1.08 |
| C2H3CL | 39175 | VINYL CHLORIDE | 2.07 | 50 | 1.16 |
| C2H5CL | 34311 | CHLOROETHANE | 1.6 | 50 | 1.24 |
| C6H6 + | 34030 | BENZENE | 0.651 | 49 | 1.07 |
| CCL3F | 34488 | TRICHLOROFLUOROMETHANE | 0.503 | 51.5 | 1.06 |
| CCL4 | 32102 | CARBON TETRACHLORIDE | 2.81 | 49 | 1.03 |
| CH2CL2 | 34423 | METHYLINE CHLORIDE | 3.1 | 49 | 1.05 |
| CH3BR | 34413 | BROMOMETHANE | 2.68 | 50 | 1.20 |
| CH3CL | 34418 | CHLOROMETHANE | 1.98 | 50 | 1.04 |
| CHBR3 | 32104 | BROMOFORM | 4.03 | 52 | 1.06 |
| CHCL3 + | 32106 | CHLOROFORM | 1.26 | 50 | 1.05 |
| CLC6H5 + | 34301 | CHLOROBENZENE | 0.582 | 50.5 | 0.988 |
| DBRCLM | 34306 | DIBROMOCHLOROMETHANE | 0.352 | 51.5 | 1.10 |
| ETC6H5 + | 34371 | ETHYLBENZENE | 0.857 | 49.5 | 0.999 |
| MEC6H5 + | 34010 | TOLUENE | 0.716 | 49.5 | 0.990 |
| T13DCP | 34699 | TRANS-1,3-DICHLOROPROPENE | 0.326 | 49.5 | 1.10 |
| TCLEA | 34516 | 1,1,2,2-TETRACHLOROETHANE | 1.09 | 52 | 0.935 |
| TCLEE + | 34475 | TETRACHLOROETHENE | 0.677 | 51 | 0.996 |
| TRCLE + | 39180 | TRICHLOROETHENE | 3.59 | 50 | 1.05 |
| XYLEN | 81551 | XYLENE | 1.73 | 102 | 0.995 |
| 13DCLB | 34566 | 1,3-DICHLOROBENZENE | 1.34 | 50 | 0.921 |
| 13DMB | 77348 | 1,3-DIMETHYLBENZENE | 1.56 | 49.5 | 1.00 |
| CCL2F2 | 34668 | DICHLORODIFLUOROMETHANE | 2.04 | 50 | 1.25 |
| CL2BZ | 81524 | DICHLOROBENZENE | 6.22 | 111 | 0.942 |
| T12DCE | 34546 | TRANS-1,2-DICHLOROETHENE | 0.427 | 49 | 1.04 |

| | |
|---|---|
| + | These compounds are used as control spikes for this method. |
| CRL | CERTIFIED REPORTING LIMIT IN (micrograms per liter) |
| UCR | UPPER CERTIFIED RANGE IN (micrograms per liter) |
| SLOPE | REPRESENTS AVERAGE ACCURACY OVER THE CERTIFIED RANGE |

The numbers in () are the EPA Method Numbers for this method.

## UT02
## IMPA, MPA IN WATER BY IC

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| FC2A | | FLUOROACETIC ACID | 100 | 9000 | 1.006 |
| IMPA | | ISOPROPYLMETHYL PHOSPHONIC ACID | 100 | 9000 | 0.991 |
| MPA | | METHYLPHOSPHONIC ACID | 128 | 9000 | 1.023 |

No EPA Method Number is available at this time.

## UW17
## NITROGUANIDINE IN WATER BY HPLC

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| NGD | 97796 | NITROGUANIDINE | 30.9 | 620 | 0.956 |

## UW18
## PHENOLS IN WATER BY HPLC

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| 246TCP | 36421 | 2,4,6-TRICHLOROPHENOL | 1.9 | 111 | 0.743 |
| 24DCLP | 34601 | 2,4-DICHLOROPHENOL | 0.617 | 115 | 0.739 |
| 2CLP | 34586 | 2-CHLOROPHENOL | 1.69 | 88 | 0.623 |
| 2NP | 34591 | 2-NITROPHENOL | 0.363 | 27.2 | 0.684 |
| 46DN2C | 34657 | 2-METHYL-4,6-DINITROPHENOL | 0.295 | 25.8 | 0.700 |
| 4CL3C | 34452 | 4-CHLORO-3-METHYL PHENOL | 5.56 | 69.7 | 0.693 |
| 4NP | 34646 | 4-NITROPHENOL | 0.27 | 31.9 | 0.762 |
| PCP | 39032 | PENTACHLOROPHENOL | 1.49 | 16.4 | 0.891 |
| PHENOL | 34694 | PHENOL | 7.99 | 103.0 | 0.681 |

## UW19
## PETN/NITROGLYSERIN IN WATER BY HPLC

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| NG | 99808 | NITROGLYCERIN | 10.0 | 200 | 1.04 |
| PETN | 99620 | PENTAERYTHRITOL TETRANITRATE | 20.0 | 400 | 1.05 |

There is no EPA Method Number available for this method.

## UW22
## THIODIGLYCOL IN WATER BY GCFP

| SHORT NAME | STORET | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|---|
| TDGCL | 99797 | THIODIGLYCOL | 48.8 | 4880 | 0.687 |
| TDGCLA | 97399 | THIODIGLYCOLIC ACID | 52.7 | 1780 | 0.930 |

No EPA Method Number is available at this time.

## UW32 (609)
## NITROAROMATICS IN WATER BY HPLC

| SHORT NAME | LONG NAME | CRL | UCR | SLOPE |
|---|---|---|---|---|
| HMX | CYCLOTETRAMETHYLENE TETRANITRAMINE | 1.21 | 120.8 | 1.00 |
| RDX + | CYCLONITE | 1.17 | 116.8 | 0.952 |
| 135TNB+ | 1,3,5-TRINITROBENZENE | 0.449 | 59.2 | 0.993 |
| 13DNB | 1,3-DINITROBENZENE | 0.611 | 55.0 | 0.95 |
| NB + | NITROBENZENE | 0.645 | 29.0 | 0.919 |
| TETRYL | NITRAMINE | 1.56 | 107.5 | 1.00 |
| 246TNT+ | 2,4,6-TRINITROTOLUENE | 0.635 | 112.0 | 0.911 |
| 26DNT | 2,6-DINITROTOLUENE | 0.0738 | 24.4 | 0.985 |
| 24DNT + | 2,4-DINITROTOLUENE | 0.0637 | 21.2 | 0.929 |
| 4A26DT | 4-AMINO-2,6-DINITROTOLUENE | 1.57 | 20.8 | 1.12 |
| 2A46DT | 2-AMINO-4,6-DINITROTOLUENE | 0.158 | 22.0 | 0.973 |
| 2NT | 2-NITROTOLUENE | 0.406 | 122.6 | 0.936 |
| 3NT | 3-NITROTOLUENE | 1.40 | 116.8 | 0.934 |
| 4NT | 4-NITROTOLUENE | 1.11 | 120.4 | 0.913 |

Number in () is the EPA Method Number.

# METHOD LM18 (8270); EXTRACTABLE ORGANICS IN SOIL BY GC/MS FOR BOTH PRIORITY POLLUTANTS AND HAZARDOUS SUBSTANCE LIST COMPOUNDS

| SHORT NAME | STORET | LONG NAME | PRIORITY POLL. | HAZARDOUS SUBST. LIST | USATHAMA CRL | USATHAMA UCR | USATHAMA SLOPE | CLP CRDL |
|---|---|---|---|---|---|---|---|---|
| 124TCB | 99492 | 1,2,4-TRICHLOROBENZENE | Y | Y | 0.04 | 13 | 0.801 | 0.3 |
| 12DCLB | 99470 | 1,2-DICHLOROBENZENE | Y | Y | 0.11 | 13 | 0.734 | 0.3 |
| 13DCLB | 99472 | 1,3-DICHLOROBENZENE | Y | Y | 0.13 | 13 | 0.724 | 0.3 |
| 14DCLB | 99469 | 1,4-DICHLOROBENZENE | Y | Y | 0.098 | 13 | 0.715 | 0.3 |
| 245TCP | 97732 | 2,4,5-TRICHLOROPHENOL | N | Y | 0.10 | 13 | 0.897 | 2 |
| 24DCLP | 99498 | 2,4-DICHLOROPHENOL | Y | Y | 0.18 | 13 | 0.909 | 0.3 |
| 24DMPN | 99499 | 2,4-DIMETHYLPHENOL | Y | Y | 0.69 | 1.3 | 0.917 | 0.3 |
| 24DNP | 99495 | 2,4-DINITROPHENOL | Y | Y | 1.2 | 6.7 | 0.816 | 2 |
| 24DNT | 99474 | 2,4-DINITROTOLUENE | Y | Y | 0.14 | 13 | 0.936 | 0.3 |
| 2CLP | 99497 | 2-CHLOROPHENOL | Y | Y | 0.06 | 13 | 0.745 | 0.3 |
| 2CNAP | 99464 | 2-CHLORONAPHTHALENE | Y | Y | 0.036 | 13 | 0.847 | 0.3 |
| 2MNAP | 97733 | 2-METHYLNAPHTHALENE | N | Y | 0.049 | 6.7 | 0.828 | 0.3 |
| 2MP | 97461 | 2-METHYLPHENOL | N | Y | 0.029 | 1.3 | 0.490 | 0.3 |
| 2NANIL | 97728 | 2-NITROANILINE | N | Y | 0.062 | 13 | 0.865 | 2 |
| 2NP | 99495 | 2-NITROPHENOL | Y | Y | 0.14 | 13 | 0.915 | 0.3 |
| 33DCBD | 99471 | 3,3-DICHLOROBENZIDINE | Y | Y | 6.3 | 13 | 0.633 | 0.7 |
| 3NANIL | 9772 | 3-NITROANILINE | N | Y | 0.45 | 13 | 0.909 | 2 |
| 46DN2C | 99686 | 2-METHYL-4,6-DINITROPHENOL | Y | Y | 0.55 | 13 | 1.060 | 2 |
| 4BRPPE | 99462 | 4-BROMOPHENYLPHENYL ETHER | Y | Y | 0.033 | 6.7 | 0.921 | 0.3 |
| 4CL3C | 99683 | 3-METHYL-4-CHLOROPHENOL | Y | Y | 0.095 | 13 | 0.894 | 0.3 |
| 4CLPPE | 99465 | 4-CHLOROPHENYLPHENYL ETHER | Y | Y | 0.033 | 13 | 0.826 | 0.3 |
| 4MP | 97460 | 4-METHYLPHENOL | N | Y | 0.24 | 1.3 | 0.439 | 0.3 |
| 4NANIL | 97730 | 4-NITROANILINE | N | Y | 0.41 | 13 | 0.739 | 2 |
| 4NP | 99496 | 4-NITROPHENOL | Y | Y | 1.4 | 33 | 0.921 | 2 |
| ANAPNE | 99450 | ACENAPHTHENE | Y | Y | 0.036 | 13 | 0.826 | 0.3 |
| ANAPYL | 99451 | ACENAPHTHYLENE | Y | Y | 0.033 | 6.7 | 0.881 | 0.3 |
| ANTRC | 99452 | ANTHRACENE | Y | Y | 0.033 | 13 | 0.870 | 0.3 |
| B2CEXM | 99459 | BIS(2-CHLOROETHOXY) METHANE | Y | Y | 0.059 | 13 | 0.863 | 0.3 |
| B2CIPE | 99461 | BIS(2-CHLOROISOPROPYL) ETHER | Y | Y | 0.2 | 13 | 0.819 | 0.3 |
| B2CLEE | 99458 | BIS(2-CHLOROETHYL) ETHER | Y | Y | 0.033 | 6.7 | 0.802 | 0.3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| B2EHP | 99460 | BIS(2-EHTYLHEXYL) PHTHALATE | Y | Y | 0.62 | 13 | 0.974 | 0.3 |
| BAANTR | 99453 | BENZO [A] ANTHRACENE | Y | Y | 0.17 | 13 | 1.06 | 0.3 |
| BAPYR | 99456 | BENZO [A] PYRENE | Y | Y | 0.25 | 13 | 0.840 | 0.3 |
| BBFANT | 99454 | BENZO [B] FLUORANTHENE | Y | Y | 0.21 | 3.3 | 0.785 | 0.3 |
| BBZP | 99463 | BUTYLBENZYL PHTHALATE | Y | Y | 0.17 | 6.7 | 0.963 | 0.3 |
| BENZOA | | BENZOIC ACID | N | Y | | | | 2 |
| BGHIPY | 99691 | BENZO [G,H,I] PERYLENE | Y | Y | 0.25 | 3.3 | 1.020 | 0.3 |
| BKFANT | 99454 | BENZO [K] FLUORANTHENE | Y | Y | 0.066 | 0.67 | 0.964 | 0.3 |
| BZALC | 97731 | BENZYL ALCOHOL | N | Y | 0.19 | 13 | 0.963 | 0.3 |
| CHRY | 99690 | CHRYSENE | Y | Y | 0.12 | 6.7 | 0.816 | 0.3 |
| CL6BZ | 99478 | HEXACHLOROBENZENE | Y | Y | 0.033 | 6.7 | 0.907 | 0.3 |
| CL6CP | 98647 | HEXACHLOROCYCLOPENTADIENE | Y | Y | 6.2 | 13 | 0.131 | 0.3 |
| CL6ET | 99480 | HEXACHLOROETHANE | Y | Y | 0.15 | 13 | 0.716 | 0.3 |
| DBAHA | 99466 | DIBENZ [A,H] ANTHRACENE | Y | Y | 0.21 | 13 | 0.999 | 0.3 |
| DBZFUR | 97727 | DIBENZOFURAN | N | Y | 0.035 | 6.7 | 0.901 | 0.3 |
| DEP | 99472 | DIETHYL PHTHALATE | Y | Y | 0.24 | 6.7 | 0.927 | 0.3 |
| DMP | 99473 | DIMETHYL PHTHALATE | Y | Y | 0.17 | 13 | 0.890 | 0.3 |
| DNBP | 99467 | DI-N-BUTYL PHTHALATE | Y | Y | 0.061 | 3.3 | 0.935 | 0.3 |
| FANT | 99689 | FLUORANTHENE | Y | Y | 0.068 | 13 | 0.863 | 0.3 |
| FLRENE | 99692 | FLUORENE | Y | Y | 0.033 | 13 | 0.856 | 0.3 |
| HCBD | 99479 | HEXACHLOROBUTADIENE | Y | Y | 0.23 | 13 | 0.747 | 0.3 |
| ICDPYR | 99482 | INDENO [1,2,3-CD] PYRENE | Y | Y | 0.29 | 13 | 0.948 | 0.3 |
| ISOPHR | 99483 | ISOPHORONE | Y | Y | 0.033 | 13 | 0.833 | 0.3 |
| NAP | 99696 | NAPHTHALENE | Y | Y | 0.037 | 3.3 | 0.858 | 0.3 |
| NB | 99485 | NITROBENZENE | Y | Y | 0.045 | 13 | 0.840 | 0.3 |
| NNDNPA | 99487 | N-NITROSO, DI-N-PROPYLAMINE | Y | Y | 0.2 | 13 | 0.849 | 0.3 |
| NNDPA | 99488 | N-NITROSODIPHENYLAMINE | Y | Y | 0.19 | 13 | 0.848 | 0.3 |
| PCP | 99682 | PENTACHLOROPHENOL | Y | Y | 1.3 | 6.7 | 0.790 | 2 |
| PHANTR | 99489 | PHENANTHRENE | Y | Y | 0.033 | 13 | 0.969 | 0.3 |
| PHENOL | 99685 | PHENOL | Y | Y | 0.11 | 3.3 | 0.811 | 0.3 |
| PYR | 99490 | PYRENE | Y | Y | 0.033 | 3.3 | 0.845 | 0.3 |
| 246TCP | 99684 | 2,4,6-TRICHLOROPHENOL | Y | Y | 0.17 | 13 | 0.948 | 0.3 |
| 26DNT | 9947 | 2,6-DINITROTOLUENE | Y | Y | 0.085 | 13 | 0.954 | 0.3 |
| 4CANIL | 97726 | 4-CHLOROANILINE | N | Y | 0.81 | 3.3 | 0.517 | 0.3 |
| DNOP | 99476 | DI-N-OCTYL PHTHALATE | Y | Y | 0.19 | 6.7 | 0.712 | 0.3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | NON-CERTIFIED ANALYTES | | | | |
| MEXCLR | 97569 | METHOXYCHLOR | N | Y | 0.33 | 5 |
| CLDANA | 97767 | CHLORDANE, ALPHA | Y | Y | 0.33 | 5 |
| CLDANG | 97768 | CHLORDANE, GAMMA | Y | Y | 0.33 | 5 |
| ALDRN | 98356 | ALDRIN | Y | Y | 0.33 | 0.5 |
| ABHC | 98357 | BHC, A | Y | Y | 0.27 | 0.5 |
| BBHC | 98358 | BHC, B | Y | Y | 0.27 | 0.5 |
| DBHC | 98359 | BHC, D | Y | Y | 0.27 | 0.5 |
| PPDDD | 98362 | DDD, PP | Y | Y | 0.3 | 1.0 |
| PPDDE | 98363 | DDE, PP | Y | Y | 0.31 | 1.0 |
| PPDDT | 98364 | DDT, PP | Y | Y | 0.31 | 1.0 |
| DLDRN | 98365 | DIELDRIN | Y | Y | 0.31 | 1.0 |
| AENSLF | 98366 | ENDOSULFAN A | Y | Y | 0.62 | 0.5 |
| BENSLF | 98367 | ENDOSULFAN B | Y | Y | 0.62 | 1.0 |
| ESFSO4 | 98368 | ENDOSULFAN SULFATE | Y | Y | 0.62 | 1.0 |
| ENDRIN | 98369 | ENDRIN | Y | Y | 0.45 | 1.0 |
| HPCL | 98371 | HEPTACHLOR | Y | Y | 0.13 | 0.5 |
| HPCLE | 98372 | HEPTACHLOR EPOXIDE | Y | Y | 0.33 | 0.5 |
| GBHC | 98360 | BHC, G (LINDANE) | Y | Y | 0.27 | 0.5 |
| PCB016 | 98140 | PCB - 1016 | Y | Y | 1.4 | 5 |
| PCB221 | 98351 | PCB - 1221 | Y | Y | 1.4 | 5 |
| PCB232 | 98352 | PCB - 1232 | Y | Y | 1.4 | 5 |
| PCB242 | 98353 | PCB - 1242 | Y | Y | 1.4 | 5 |
| PCB248 | 98436 | PCB - 1248 | Y | Y | 2.0 | 5 |
| PCB254 | 98354 | PCB - 1254 | Y | Y | 2.3 | 10 |
| PCB260 | 98139 | PCB - 1260 | Y | Y | 2.6 | 10 |
| TXPHEN | 98373 | TOXAPHENE | Y | Y | 2.6 | 10 |
| BENZID | 99457 | BENZIDINE | Y | N | 0.85 | |
| ENDRNA | 98370 | ENDRIN ALDEHYDE | Y | N | 0.53 | |
| NNDMEA | 99486 | N-NITROSODIMETHYLAMINE | Y | N | 0.14 | |
| KEND | 97720 | ENDRIN KETONE | N | Y | 0.53 | 1.0 |
| 12DPH | 99477 | 1,2-DIPHENYL HYDRAZINE | Y | N | 0.14 | |

| | SURROGATES | | | | |
|---|---|---|---|---|---|
| 246TBP | 97448 | 2,4,6-TRIBROMOPHENOL | 0.38 | 13 | 0.910 |
| 2FBP | 98814 | 2-FLUOROBIPHENYL | 0.021 | 6.7 | 0.903 |
| 2FP | 98325 | 2-FLUOROPHENOL | | | |
| NBD5 | 97022 | NITROBENZENE-D5 | 0.025 | 6.7 | 0.858 |
| TRPD14 | 97449 | TERPHENYL-D14 | 0.34 | 6.7 | 1.070 |
| PHEND6 | 97023 | PHENOL-D6 | 0.23 | 13 | 0.824 |

Number in () is the EPA Method Number.

# METHOD LM19 (8240); VOLATILE ORGANICS IN SOIL BY GC/MS FOR BOTH PRIORITY POLLUTANTS AND HAZARDOUS SUBSTANCE LIST COMPOUNDS

| SHORT NAME | STORET | LONG NAME | PRIORITY POLL. | HAZARDOUS SUBST. LIST | USATHAMA CRL | USATHAMA UCR | USATHAMA SLOPE | CLP CRDL |
|---|---|---|---|---|---|---|---|---|
| 111TCE | 98692 | 1,1,1-TRICHLOROETHANE | Y | Y | 4.4 | 200 | 1.200 | 5 |
| 112TCE | 98693 | 1,1,2-TRICHLOROETHANE | Y | Y | 5.4 | 200 | 1.100 | 5 |
| 11DCE | 98789 | 1,1-DICHLOROETHENE | Y | Y | 3.9 | 100 | 1.070 | 5 |
| 11DCLE | 98683 | 1,1-DICHLOROETHANE | Y | Y | 2.3 | 200 | 1.030 | 5 |
| 12DCE | 97721 | 1,2-DICHLOROETHENE | | | 3.0 | 100 | 0.986 | 5 |
| 12DCLE | 98684 | 1,2-DICHLOROETHANE | Y | Y | 1.7 | 200 | 1.020 | 5 |
| 12DCLP | 98790 | 1,2-DICHLOROPROPANE | Y | Y | 2.9 | 200 | 1.100 | 5 |
| ACET | 97020 | ACETONE | N | Y | 17.0 | 100 | 0.970 | 10 |
| BRDCLM | 98783 | BROMODICHLOROMETHANE | Y | Y | 2.9 | 200 | 1.180 | 5 |
| C13DCP | 98791 | CIS-1,3-DICHLOROPROPENE | Y | Y | 3.2 | 248 | 1.130 | 5 |
| C2AVE | 97723 | VINYL ACETATE | N | Y | 3.2 | 100 | 1.370 | 10 |
| C2H3CL | 98795 | VINYL CHLORIDE | Y | Y | 6.2 | 200 | 1.090 | 10 |
| C2H5CL | 98786 | CHLOROETHANE | Y | Y | 12.0 | 200 | 1.050 | 10 |
| C6H6 | 98699 | BENZENE | Y | Y | 1.5 | 200 | 1.020 | 5 |
| CCL3F | 98794 | TRICHLOROFLUOROMETHANE | Y | N | 5.9 | 100 | 1.170 | |
| CCL4 | 98680 | CARBON TETRACHLORIDE | Y | Y | 7.0 | 200 | 1.270 | 5 |
| CH2CL2 | 98689 | METHYLENE CHLORIDE | Y | Y | 12.0 | 200 | 0.988 | 5 |
| CH3BR | 98785 | BROMOMETHANE | Y | Y | 5.7 | 200 | 0.891 | 10 |
| CH3CL | 98787 | CHLOROMETHANE | Y | Y | 8.8 | 100 | 0.882 | 10 |
| CHBR3 | 98784 | BROMOFORM | Y | Y | 6.9 | 200 | 1.330 | 5 |
| CHCL3 | 98682 | CHLOROFORM | Y | Y | 0.87 | 200 | 1.030 | 5 |
| CLC6H5 | 98681 | CHLOROBENZENE | Y | Y | 0.86 | 200 | 1.070 | 5 |
| CS2 | 97472 | CARBON DISULFIDE | N | Y | 4.4 | 100 | 0.993 | 5 |
| DBRCLM | 98788 | DIBROMOCHLOROMETHANE | N | Y | 3.1 | 200 | 1.230 | 5 |
| ETC6H5 | 98688 | ETHYLBENZENE | Y | Y | 1.7 | 200 | 1.030 | 5 |
| MEC6H5 | 98691 | TOLUENE | Y | Y | 0.78 | 200 | 1.020 | 5 |
| MEK | 98801 | METHYL ETHYL KETONE | N | Y | 70.0 | 200 | 1.140 | 10 |
| MIBK | 98696 | METHYL ISOBUTYL KETONE | N | Y | 27.0 | 100 | 1.300 | 10 |
| MNBK | 97722 | METHYL-N-BUTYL KETONE | N | Y | 32.0 | 100 | 1.240 | 10 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| STYR | 97734 | STYRENE | N | Y | 2.6 | 200 | 1.030 | 5 |
| T13DCP | 98792 | TRANS-1,3-DICHLOROPROPENE | N | Y | 2.8 | 152 | 1.150 | 5 |
| TCLEA | 98793 | 1,1,2,2-TETRACHLOROETHANE | Y | Y | 2.4 | 200 | 1.130 | 5 |
| TCLEE | 98690 | TETRACHLOROETHENE | Y | Y | 0.81 | 200 | 1.030 | 5 |
| TRCLE | 98694 | TRICHLOROETHENE | Y | Y | 2.8 | 200 | 1.160 | 5 |
| XYLEN | 97724 | XYLENE | N | Y | 1.5 | 200 | 1.010 | 5 |
| | NON-CERTIFIED ANALYTES | | | | | | | |
| CL2BC | 98803 | DICHLOROBENZENE (TOTAL) | | | | | | |
| ACROLN | 97028 | ACROLEIN | | | | | | |
| ACRYLO | 97029 | ACRYLONITRILE | | | | | | |
| 2CLEVE | 98796 | 2-CHLOROETHYLVINYL ETHER | | | | | | |
| | SURROGATES | | | | | | | |
| 12DCD4 | | 1,2-DICHLOROETHANE-D4 | | | 3.2 | 200 | 0.995 | |
| 4BFB | | 4-BROMOFLUOROBENZENE | | | 2.9 | 200 | 1.100 | |
| MEC6D8 | | TOLUENE-D8 | | | 1.5 | 200 | 0.999 | |

Number in () is the EPA Method Number.
All concentrations are in ug/kg

# METHOD UM18 (625); EXTRACTABLE ORGANICS IN WATER BY GC/MS FOR BOTH PRIORITY POLLUTANTS AND HAZARDOUS SUBSTANCE LIST COMPOUNDS

| SHORT NAME | STORET | LONG NAME | PRIORITY POLL. | HAZARDOUS SUBST. LIST | USATHAMA CRL | USATHAMA UCR | USATHAMA SLOPE | CLP CRDL |
|---|---|---|---|---|---|---|---|---|
| 124TCB | 34551 | 1,2,4-TRICHLOROBENZENE | Y | Y | 1.8 | 50 | 0.824 | 10 |
| 12DCLB | 34536 | 1,2-DICHLOROBENZENE | Y | Y | 1.7 | 50 | 0.856 | 10 |
| 13DCLB | 34566 | 1,3-DICHLOROBENZENE | Y | Y | 1.7 | 200 | 0.790 | 10 |
| 14DCLB | 34571 | 1,4-DICHLOROBENZENE | Y | Y | 1.7 | 200 | 0.786 | 10 |
| 245TCP | 77687 | 2,4,5-TRICHLOROPHENOL | N | Y | 5.2 | 200 | 1.060 | 50 |
| 24DCLP | 34601 | 2,4-DICHLOROPHENOL | Y | Y | 2.9 | 200 | 0.930 | 10 |
| 24DMPN | 34606 | 2,4-DIMETHYLPHENOL | Y | Y | 5.8 | 100 | 0.938 | 10 |
| 24DNP | 34616 | 2,4-DINITROPHENOL | Y | Y | 21.0 | 100 | 1.370 | 50 |
| 24DNT | 34611 | 2,4-DINITROTOLUENE | Y | Y | 4.5 | 200 | 0.954 | 10 |
| 2CLP | 34586 | 2-CHLOROPHENOL | Y | Y | 0.99 | 200 | 0.967 | 10 |
| 2CNAP | 34581 | 2-CHLORONAPHTHALENE | Y | Y | 0.5 | 200 | 0.880 | 10 |
| 2MNAP | 77416 | 2-METHYLNAPHTHALENE | N | Y | 1.7 | 50 | 0.919 | 10 |
| 2MP | 99073 | 2-METHYLPHENOL | N | Y | 3.9 | 200 | 0.967 | 10 |
| 2NANIL | 99077 | 2-NITROANILINE | N | Y | 4.3 | 100 | 0.958 | 50 |
| 2NP | 34591 | 2-NITROPHENOL | Y | Y | 3.7 | 100 | 0.986 | 10 |
| 33DCBD | 34631 | 3,3-DICHLOROBENZIDINE | Y | Y | 12.0 | 100 | 1.530 | 20 |
| 3NANIL | 99078 | 3-NITROANILINE | N | Y | 4.9 | 100 | 0.965 | 50 |
| 46DN2C | 34657 | 2-METHYL-4,6-DINITROPHENOL | Y | Y | 17.0 | 100 | 1.220 | 50 |
| 4BRPPE | 34636 | 4-BROMOPHENYLPHENYL ETHER | Y | Y | 4.2 | 100 | 0.902 | 10 |
| 4CL3C | 34452 | 3-METHYL-4-CHLOROPHENOL | Y | Y | 4.0 | 200 | 0.989 | 10 |
| 4CLPPE | 34641 | 4-CHLOROPHENYLPHENYL ETHER | Y | Y | 5.1 | 100 | 0.856 | 10 |
| 4MP | 99074 | 4-METHYLPHENOL | N | Y | 0.52 | 200 | 0.848 | 10 |
| 4NANIL | 99079 | 4-NITROANILINE | N | Y | 5.2 | 100 | 1.010 | 50 |
| 4NP | 34646 | 4-NITROPHENOL | Y | Y | 12.0 | 100 | 0.662 | 50 |
| ANAPNE | 34205 | ACENAPHTHENE | Y | Y | 1.7 | 50 | 0.946 | 10 |
| ANAPYL | 34200 | ACENAPHTHYLENE | Y | Y | 0.5 | 50 | 0.966 | 10 |
| ANTRC | 34220 | ANTHRACENE | Y | Y | 0.5 | 100 | 0.974 | 10 |
| B2CEXM | 34278 | BIS(2-CHLOROETHOXY) METHANE | Y | Y | 1.5 | 50 | 0.928 | 10 |
| B2CIPE | 34283 | BIS(2-CHLOROISOPROPYL) ETHER | Y | Y | 5.3 | 200 | 0.834 | 10 |
| B2CLEE | 34273 | BIS(2-CHLOROETHYL) ETHER | Y | Y | 1.9 | 50 | 0.943 | 10 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| B2EHP | 39100 | BIS(2-EHTYLHEXYL) PHTHALATE | Y | Y | 4.8 | 100 | 1.100 | 10 |
| BAANTR | 34526 | BENZO [A] ANTHRACENE | Y | Y | 1.6 | 100 | 0.996 | 10 |
| BAPYR | 34247 | BENZO [A] PYRENE | Y | Y | 4.7 | 100 | 1.120 | 10 |
| BBFANT | 34230 | BENZO [B] FLUORANTHENE | Y | Y | 5.4 | 50 | 1.050 | 10 |
| BBZP | 34292 | BUTYLBENZYL PHTHALATE | Y | Y | 3.4 | 100 | 1.060 | 10 |
| BENZOA | 77247 | BENZOIC ACID | N | Y | 13.0 | 100 | 0.646 | 50 |
| BGHIPY | 34521 | BENZO [G,H,I] PERYLENE | Y | Y | 6.1 | 50 | 1.300 | 10 |
| BKFANT | 34242 | BENZO [K] FLUORANTHENE | Y | Y | 0.87 | 100 | 1.020 | 10 |
| BZALC | 77147 | BENZYL ALCOHOL | N | Y | 0.72 | 100 | 0.861 | 10 |
| CHRY | 34320 | CHRYSENE | Y | Y | 2.40 | 100 | 0.967 | 10 |
| CL6BZ | 39700 | HEXACHLOROBENZENE | Y | Y | 1.6 | 100 | 0.949 | 10 |
| CL6CP | 34386 | HEXACHLOROCYCLOPENTADIENE | Y | Y | 8.6 | 100 | 0.707 | 10 |
| CL6ET | 34396 | HEXACHLOROETHANE | Y | Y | 1.5 | 50 | 0.818 | 10 |
| DBAHA | 34556 | DIBENZ [A,H] ANTHRACENE | Y | Y | 6.5 | 50 | 1.160 | 10 |
| DBZFUR | 81302 | DIBENZOFURAN | N | Y | 1.7 | 50 | 0.941 | 10 |
| DEP | 34336 | DIETHYL PHTHALATE | Y | Y | 2.0 | 200 | 0.863 | 10 |
| DMP | 34341 | DIMETHYL PHTHALATE | Y | Y | 1.5 | 100 | 0.807 | 10 |
| DNBP | 39110 | DI-N-BUTYL PHTHALATE | Y | Y | 3.7 | 200 | 1.100 | 10 |
| FANT | 34376 | FLUORANTHENE | Y | Y | 3.3 | 100 | 0.996 | 10 |
| FLRENE | 34381 | FLUORENE | Y | Y | 3.7 | 50 | 0.960 | 10 |
| HCBD | 34391 | HEXACHLOROBUTADIENE | Y | Y | 3.4 | 100 | 0.731 | 10 |
| ICDPYR | 34403 | INDENO [1,2,3-CD] PYRENE | Y | Y | 8.6 | 100 | 1.170 | 10 |
| ISOPHR | 34408 | ISOPHORONE | Y | Y | 4.8 | 50 | 0.971 | 10 |
| NAP | 34696 | NAPHTHALENE | Y | Y | 0.5 | 20 | 1.150 | 10 |
| NB | 34447 | NITROBENZENE | Y | Y | 0.5 | 50 | 0.887 | 10 |
| NNDNPA | 34428 | N-NITROSO, DI-N-PROPYLAMINE | Y | Y | 4.4 | 50 | 0.987 | 10 |
| NNDPA | 34433 | N-NITROSODIPHENYLAMINE | Y | Y | 3.0 | 200 | 0.956 | 10 |
| PCP | 39032 | PENTACHLOROPHENOL | Y | Y | 18.0 | 100 | 1.260 | 50 |
| PHANTR | 34461 | PHENANTHRENE | Y | Y | 0.5 | 100 | 1.000 | 10 |
| PHENOL | 34694 | PHENOL | Y | Y | 9.2 | 200 | 0.542 | 10 |
| PYR | 34469 | PYRENE | Y | Y | 2.8 | 100 | 0.995 | 10 |
| 246TCP | 34621 | 2,4,6-TRICHLOROPHENOL | Y | Y | 4.2 | 100 | 1.02 | 10 |
| 26DNT | 34626 | 2,6-DINITROTOLUENE | Y | Y | 0.79 | 200 | 1.09 | 10 |
| 4CANIL | 99075 | 4-CHLOROANILINE | N | Y | 7.3 | 100 | 0.872 | 10 |
| DNOP | 34596 | DI-N-OCTYL PHTHALATE | Y | Y | 15.0 | 100 | 1.28 | 10 |

| | NON-CERTIFIED ANALYTES | | | | | |
|---|---|---|---|---|---|---|
| MEXCLR | 39480 | METHOXYCHLOR | N | Y | 5.1 | 0.5 |
| CLDANA | 39348 | CHLORDANE, ALPHA | Y | Y | 5.1 | 0.5 |
| CLDANG | 39810 | CHLORDANE, GAMMA | Y | Y | 5.1 | 0.5 |
| ALDRN | 39330 | ALDRIN | Y | Y | 4.7 | 0.05 |
| ABHC | 39337 | BHC, A | Y | Y | 4.0 | 0.05 |
| BBHC | 39338 | BHC, B | Y | Y | 4.0 | 0.05 |
| DBHC | 34259 | BHC, D | Y | Y | 4.0 | 0.05 |
| PPDDD | 39310 | DDD, PP | Y | Y | 4.0 | 0.10 |
| PPDDE | 39320 | DDE, PP | Y | Y | 4.7 | 0.10 |
| PPDDT | 39300 | DDT, PP | Y | Y | 9.2 | 0.10 |
| DLDRN | 39380 | DIELDRIN | Y | Y | 4.7 | 0.10 |
| AENSLF | 34361 | ENDOSULFAN A | Y | Y | 9.2 | 0.05 |
| BENSLF | 34356 | ENDOSULFAN B | Y | Y | 9.2 | 0.10 |
| ESFSO4 | 34351 | ENDOSULFAN SULFATE | Y | Y | 9.2 | 0.10 |
| ENDRIN | 39390 | ENDRIN | Y | Y | 7.6 | 0.10 |
| HPCL | 39410 | HEPTACHLOR | Y | Y | 2.0 | 0.05 |
| HPCLE | 39420 | HEPTACHLOR EPOXIDE | Y | Y | 5.0 | 0.05 |
| GBHC | 39340 | BHC, G (LINDANE) | Y | Y | 4.0 | 0.05 |
| PCB016 | 34671 | PCB - 1016 | Y | Y | 21.0 | 0.5 |
| PCB221 | 39488 | PCB - 1221 | Y | Y | 21.0 | 0.5 |
| PCB232 | 39492 | PCB - 1232 | Y | Y | 21.0 | 0.5 |
| PCB242 | 39496 | PCB - 1242 | Y | Y | 30.0 | 0.5 |
| PCB248 | 39500 | PCB - 1248 | Y | Y | 30.0 | 0.5 |
| PCB254 | 39504 | PCB - 1254 | Y | Y | 36.0 | 1.0 |
| PCB260 | 39508 | PCB - 1260 | Y | Y | 36.0 | 1.0 |
| TXPHEN | 39400 | TOXAPHENE | Y | Y | 36.0 | 1.0 |
| BENZID | 39120 | BENZIDINE | Y | N | 10.0 | |
| ENDRNA | 34366 | ENDRIN ALDEHYDE | Y | N | 8.0 | |
| NNDMEA | 34438 | N-NITROSODIMETHYLAMINE | Y | N | 2.0 | |
| KEND | 78008 | ENDRIN KETONE | N | Y | 8.0 | 0.10 |
| 12DPH | 34346 | 1,2-DIPHENYL HYDRAZINE | Y | N | 2.0 | |

| | SURROGATES | | | | | LCL | UCL | MAP |
|---|---|---|---|---|---|---|---|---|
| 246TBP | | 2,4,6-TRIBROMOPHENOL | 13.0 | 200 | 1.260 | 64.3 | 107.6 | 54.5 |
| 2FBP | 98321 | 2-FLUOROBIPHENYL | 12.0 | 100 | 0.891 | 65.8 | 100.8 | 44.0 |
| 2FP | 98316 | 2-FLUOROPHENOL | 17.0 | 200 | 0.657 | 50.6 | 87.1 | 46.0 |
| NBD5 | 98318 | NITROBENZENE-D5 | 11.0 | 100 | 0.845 | 66.5 | 102.0 | 44.6 |
| TRPD14 | 97447 | TERPHENYL-D14 | 14.0 | 100 | 0.878 | 78.0 | 112.0 | 42.8 |
| PHEND6 | 98317 | PHENOL-D6 | 36.0 | 200 | 0.50 | 38.8 | 63.3 | 30.9 |

Number in () is the EPA Method Number.

METHOD UM20 (624); VOLATILE ORGANICS IN WATER BY GC/MS FOR BOTH PRIORITY POLLUTANTS AND HAZARDOUS SUBSTANCE LIST COMPOUNDS

| SHORT NAME | STORET | LONG NAME | PRIORITY POLL. | HAZARDOUS SUBST. LIST | USATHAMA CRL | USATHAMA UCR | USATHAMA SLOPE | CLP CRDL |
|---|---|---|---|---|---|---|---|---|
| 111TCE | 34506 | 1,1,1-TRICHLOROETHANE | Y | Y | 0.5 | 200 | 1.01 | 5 |
| 112TCE | 34511 | 1,1,2-TRICHLOROETHANE | Y | Y | 1.2 | 200 | 0.943 | 5 |
| 11DCE | 34501 | 1,1-DICHLOROETHENE | Y | Y | 0.50 | 200 | 1.06 | 5 |
| 11DCLE | 34496 | 1,1-DICHLOROETHANE | Y | Y | 0.68 | 200 | 0.881 | 5 |
| 12DCLE | 34531 | 1,2-DICHLOROETHANE | Y | Y | 0.50 | 50 | 0.995 | 5 |
| 12DCLP | 34541 | 1,2-DICHLOROPROPANE | Y | Y | 0.50 | 200 | 1.02 | 5 |
| 2CLEVE | 34576 | 2-CHLOROETHYLVINYL ETHER | Y | N | 0.71 | 200 | 1.01 | |
| BRDCLM | 32101 | BROMODICHLOROMETHANE | Y | Y | 0.59 | 200 | 1.02 | 5 |
| C13DCP | 34704 | CIS-1,3-DICHLOROPROPENE | Y | Y | 0.58 | 230 | 1.02 | 5 |
| C2H3CL | 39175 | VINYL CHLORIDE | Y | Y | 2.6 | 200 | 0.964 | 10 |
| C2H5CL | 34311 | CHLOROETHANE | Y | Y | 1.9 | 200 | 0.980 | 10 |
| C6H6 | 34030 | BENZENE | Y | Y | 0.50 | 200 | 1.01 | 5 |
| CCL3F | 34488 | TRICHLOROFLUOROMETHANE | Y | N | 1.4 | 50 | 0.998 | |
| CCL4 | 32102 | CARBON TETRACHLORIDE | Y | Y | 0.58 | 200 | 1.05 | 5 |
| CH2CL2 | 34423 | METHYLENE CHLORIDE | Y | Y | 2.3 | 100 | 1.06 | 5 |
| CH3BR | 34413 | BROMOMETHANE | Y | Y | 5.8 | 100 | 1.01 | 10 |
| CH3CL | 34418 | CHLOROMETHANE | Y | Y | 3.2 | 200 | 0.952 | 10 |
| CHBR3 | 32104 | BROMOFORM | Y | Y | 2.60 | 200 | 1.05 | 5 |
| CHCL3 | 32106 | CHLOROFORM | Y | Y | 0.5 | 200 | 0975 | 5 |
| CLC6H5 | 34301 | CHLOROBENZENE | Y | Y | 0.5 | 200 | 1.04 | 5 |
| DBRCLM | 32105 | DIBROMOCHLOROMETHANE | N | Y | 0.67 | 100 | 0.981 | 5 |
| ETC6H5 | 34371 | ETHYLBENZENE | Y | Y | 0.5 | 200 | 1.05 | 5 |
| MEC6H5 | 34010 | TOLUENE | Y | Y | 0.5 | 200 | 1.02 | 5 |
| T13DCP | 34699 | TRANS-1,3-DICHLOROPROPENE | N | Y | 0.70 | 280 | 0.964 | 5 |
| TCLEA | 34516 | 1,1,2,2-TETRACHLOROETHANE | Y | Y | 0.51 | 200 | 1.03 | 5 |
| TCLEE | 34475 | TETRACHLOROETHENE | Y | Y | 1.6 | 200 | 0.984 | 5 |
| TRCLE | 39180 | TRICHLOROETHENE | Y | Y | 0.50 | 200 | 1.05 | 5 |
| XYLEN | 99649 | XYLENE | N | Y | 0.84 | 200 | 1.06 | 5 |
| ACET | 81552 | ACETONE | N | Y | 13.0 | 200 | 1.02 | 10 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CS2 | 77041 | CARBONDISULFIDE | N | Y | 0.5 | 200 | 0.882 | 5 | | | |
| 12DCE | 99642 | 1,2-DICHLOROETHENE (TOTAL) | | | 0.5 | 200 | 1.03 | 5 | | | |
| MEK | 81595 | 2-BUTANONE | N | Y | 6.4 | 200 | 0.992 | | | | |
| C2AVE | 77057 | VINYL ACETATE | N | Y | 8.3 | 50 | 0.984 | 10 | | | |
| MIBK | 81596 | 4-METHYL-2-PENTANONE | N | Y | 3.0 | 200 | 0.918 | 10 | | | |
| MNBK | 77103 | 2-HEXANONE | N | Y | 3.6 | 200 | 0.917 | 10 | | | |
| STYR | 77128 | STYRENE | N | Y | 0.5 | 200 | 1.10 | 5 | | | |
| | NON-CERTIFIED ANALYTES | | | | | | | | | | |
| CL2BZ | 81524 | DICHLOROBENZENE | | | | | | | | | |
| ACROLN | 34210 | ACROLEIN | | | | | | | | | |
| ACRYLO | 34215 | ACRYLONITRILE | | | | | | | | | |
| | SURROGATES | | | | | | | | LCL | UCL | MAP |
| 12DCD4 | 98812 | 1,2-DICHLOROETHANE-D4 | | | 23.0 | 200 | 0.881 | | 86.2 | 102.8 | 20.9 |
| 4BFB | | 4-BROMOFLUOROBENZENE | | | 6.5 | 200 | 1.110 | | 92.2 | 107.2 | 19.3 |
| MEC6D8 | 98810 | TOLUENE-D8 | | | 0.5 | 200 | 1.060 | | 92.0 | 110.0 | 22.7 |

Number in () is the EPA Method Number.

# A.3

# Current Control Limits

METHODS TABLE SUMMARIZING CURRENT CONTROL LIMITS FOR MERCURY AND GFAA METALS METHODS IN WATER AND SOIL 17:02:19 22 SEP 1990

| | | | | | LOW SPIKE 3 DAY MOVING ACCURACY LIMITS | | | | | PRECISION LIMITS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TST NM | STORET UNIT | CERTREPLIM | MAXIMUM CON | ACCURACY QCT | MAA LCL | MAA LWL | MAA MEAN | MAA UWL | MAA UCL | MAP MEAN | MAP UWL | MAP UCL |
| HG | 71921 UGG | .050000 | 1.0000 | 1.02000 Y | 69.79 | 77.92 | 94.19 | 110.46 | 118.59 | 23.85 | 48.90 | 61.42 |
| SE | 1148 UGG | .250000 | 10.0000 | 0.75700 Y | 50.94 | 60.91 | 80.85 | 100.79 | 110.76 | 29.23 | 59.93 | 75.28 |
| V | 1088 UGG | .775000 | 20.0000 | 0.83300 Y | 64.03 | 73.67 | 92.94 | 112.22 | 121.85 | 28.26 | 57.93 | 72.77 |
| PB | 1052 UGG | .177000 | 10.0000 | 0.89000 Y | 74.12 | 81.91 | 97.49 | 113.07 | 120.86 | 22.84 | 46.83 | 58.82 |
| AG | 1078 UGG | .025000 | 1.0000 | 0.88200 Y | 73.94 | 79.61 | 90.95 | 102.29 | 107.96 | 16.63 | 34.09 | 42.82 |
| AS | 1003 UGG | .250000 | 10.0000 | 0.84200 Y | 80.56 | 86.23 | 97.58 | 108.92 | 114.59 | 16.63 | 34.10 | 42.83 |

| | | REPLICATE HIGH SPIKE ACCURACY LIMITS | | | | | PRECISION LIMITS | | |
|---|---|---|---|---|---|---|---|---|---|
| TST NM | STORET UNIT | ACC LCL | ACC LWL | ACC MEAN | ACC UWL | ACC UCL | PREC MEAN | PREC UWL | PREC UCL |
| HG | 71921 UGG | 89.32 | 91.83 | 96.86 | 101.88 | 104.39 | 4.00 | 10.06 | 13.09 |
| SE | 1148 UGG | 66.03 | 68.82 | 74.41 | 80.00 | 82.79 | 4.46 | 11.20 | 14.57 |
| V | 1088 UGG | 88.55 | 90.79 | 95.27 | 99.75 | 101.99 | 3.57 | 8.97 | 11.67 |
| PB | 1052 UGG | 85.35 | 87.51 | 91.81 | 96.12 | 98.27 | 3.43 | 8.62 | 11.22 |
| AG | 1078 UGG | 89.43 | 90.54 | 92.78 | 95.01 | 96.12 | 1.78 | 4.47 | 5.81 |
| AS | 1003 UGG | 88.13 | 90.57 | 95.46 | 100.34 | 102.79 | 3.89 | 9.78 | 12.73 |

| | | | | | LOW SPIKE 3 DAY MOVING ACCURACY LIMITS | | | | | PRECISION LIMITS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TST NM | STORET UNIT | CERTREPLIM | MAXIMUM CON | ACCURACY QCT | MAA LCL | MAA LWL | MAA MEAN | MAA UWL | MAA UCL | MAP MEAN | MAP UWL | MAP UCL |
| HG | 71900 UGL | .243000 | 10.0000 | 1.03000 Y | 76.39 | 83.32 | 97.19 | 111.05 | 117.98 | 20.33 | 41.67 | 52.34 |
| SB | 1097 UGL | 23.000000 | 300.0000 | 1.30000 Y | | | | | | | | |
| TL | 1059 UGL | 6.990000 | 25.0000 | 0.90500 Y | 86.03 | 91.75 | 103.18 | 114.61 | 120.32 | 16.76 | 34.35 | 43.15 |
| V | 1087 UGL | 3.820000 | 200.0000 | 0.90900 Y | 71.93 | 78.94 | 92.98 | 107.01 | 114.03 | 20.57 | 42.18 | 52.98 |
| PB | 1051 UGL | 1.260000 | 100.0000 | 0.92200 Y | 46.06 | 59.09 | 85.16 | 111.22 | 124.25 | 38.22 | 78.35 | 98.41 |
| SE | 1147 UGL | 3.020000 | 100.0000 | 0.93900 Y | 76.05 | 82.39 | 95.06 | 107.73 | 114.07 | 18.58 | 38.09 | 47.84 |
| AS | 1002 UGL | 2.540000 | 100.0000 | 0.93800 Y | 71.03 | 78.95 | 94.80 | 110.64 | 118.56 | 23.23 | 47.62 | 59.82 |
| AG | 1077 UGL | .250000 | 10.0000 | 1.06000 Y | 85.99 | 90.31 | 98.95 | 107.60 | 111.92 | 12.67 | 25.98 | 32.63 |

| | | REPLICATE HIGH SPIKE ACCURACY LIMITS | | | | | PRECISION LIMITS | | |
|---|---|---|---|---|---|---|---|---|---|
| TST NM | STORET UNIT | ACC LCL | ACC LWL | ACC MEAN | ACC UWL | ACC UCL | PREC MEAN | PREC UWL | PREC UCL |
| HG | 71900 UGL | 90.83 | 94.57 | 102.07 | 109.56 | 113.30 | 5.97 | 15.01 | 19.52 |
| SB | 1097 UGL | | | | | | | | |
| TL | 1059 UGL | 89.60 | 92.63 | 98.69 | 104.75 | 107.78 | 4.83 | 12.14 | 15.79 |
| V | 1087 UGL | 92.33 | 94.57 | 99.05 | 103.54 | 105.78 | 3.57 | 8.98 | 11.68 |
| PB | 1051 UGL | 93.56 | 95.16 | 98.36 | 101.55 | 103.15 | 2.55 | 6.40 | 8.33 |
| SE | 1147 UGL | 91.26 | 92.90 | 96.19 | 99.47 | 101.11 | 2.62 | 6.57 | 8.55 |
| AS | 1002 UGL | 89.84 | 91.31 | 94.23 | 97.16 | 98.62 | 2.33 | 5.86 | 7.62 |
| AG | 1077 UGL | 93.43 | 95.41 | 99.36 | 103.32 | 105.29 | 3.15 | 7.92 | 10.30 |

"Y METHODS TABLE FOR METALS ANALYZED BY SOIL ICAP METHOD - CURRENT STANDARD MATRIX SPIKE CONTROL LIMITS 17:02:19 22 SEP 1990

| IH | TST NM | STORET | UNIT | CERTREPLIM | MAXIMUM CON | ACCURACY | QCT | LOW SPIKE 3 DAY MOVING ACCURACY LIMITS | | | | | PRECISION LIMITS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | MAA LCL | MAA LWL | MAA MEAN | MAA UWL | MAA UCL | MAP MEAN | MAP UWL | MAP UCL |
| 11 | AG | 1078 | UGG | 2.500000 | 50.0000 | 0.96500 | Y | 80.98 | 84.56 | 91.71 | 98.86 | 102.44 | 10.48 | 21.49 | 27.00 |
| 11 | AL | 1108 | UGG | 14.100000 | 5000.0000 | 1.00000 | N | | | | | | | | |
| 11 | B | 99222 | UGG | 32.700000 | 200.0000 | 0.60200 | Y | | | | | | | | |
| 11 | BA | 1008 | UGG | 29.600000 | 200.0000 | 0.62900 | Y | | | | | | | | |
| 11 | BE | 1013 | UGG | 1.860000 | 20.0000 | 0.73900 | Y | 91.91 | 94.28 | 99.04 | 103.79 | 106.17 | 6.97 | 14.28 | 17.94 |
| 11 | BI | | UGG | 31.500000 | 5000.0000 | 0.72500 | Y | | | | | | | | |
| 11 | CA | 917 | UGG | 59.000000 | 5000.0000 | 0.61500 | Y | | | | | | | | |
| 11 | CD | 1028 | UGG | 3.050000 | 20.0000 | 0.82600 | Y | 87.42 | 89.68 | 94.22 | 98.76 | 101.02 | 6.65 | 13.63 | 17.12 |
| 11 | CO | 1038 | UGG | 15.000000 | 5000.0000 | 0.60800 | Y | | | | | | | | |
| 11 | CR | 1029 | UGG | 12.700000 | 5000.0000 | 0.61300 | Y | 88.12 | 91.40 | 97.96 | 104.53 | 107.81 | 9.62 | 19.72 | 24.77 |
| 11 | CU | 1043 | UGG | 58.600000 | 5000.0000 | 0.67500 | Y | 89.91 | 92.49 | 97.66 | 102.82 | 105.40 | 7.57 | 15.52 | 19.49 |
| 11 | FE | 1170 | UGG | 50.000000 | 5000.0000 | 1.04000 | N | | | | | | | | |
| 11 | K | 938 | UGG | 37.500000 | 5000.0000 | 0.73300 | N | | | | | | | | |
| 11 | MG | 924 | UGG | 50.000000 | 5000.0000 | 0.66000 | N | | | | | | | | |
| 11 | MN | 1053 | UGG | .275000 | 5000.0000 | 0.64200 | N | | | | | | | | |
| 11 | MO | 99224 | UGG | 1.150000 | 5000.0000 | 0.65000 | Y | | | | | | | | |
| 11 | NA | 934 | UGG | 150.000000 | 5000.0000 | 0.70300 | Y | | | | | | | | |
| 11 | NI | 1068 | UGG | 12.600000 | 5000.0000 | 0.59300 | Y | 82.29 | 86.66 | 95.40 | 104.14 | 108.51 | 12.81 | 26.27 | 32.99 |
| 11 | PB | 1052 | UGG | 6.620000 | 50.0000 | 1.05000 | Y | | | | | | | | |
| 11 | SB | 1098 | UGG | 3.800000 | 5000.0000 | 0.58100 | N | | | | | | | | |
| 11 | SE | 1148 | UGG | 9.530000 | 5000.0000 | 0.60000 | Y | | | | | | | | |
| 11 | TE | | UGG | 54.200000 | 5000.0000 | 0.62800 | Y | | | | | | | | |
| 11 | TL | 34480 | UGG | 31.300000 | 5000.0000 | 0.58000 | Y | 79.83 | 83.82 | 91.81 | 99.79 | 103.79 | 11.70 | 24.00 | 30.14 |
| 11 | V | 1088 | UGG | 13.000000 | 5000.0000 | 0.65000 | Y | | | | | | | | |
| 11 | ZN | 1093 | UGG | 30.200000 | 5000.0000 | 0.57300 | Y | 85.18 | 89.59 | 98.41 | 107.24 | 111.65 | 12.93 | 26.52 | 33.31 |

| IH | TST NM | STORET | UNIT | REPLICATE HIGH SPIKE ACCURACY LIMITS | | | | | PRECISION LIMITS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ACC LCL | ACC LWL | ACC MEAN | ACC UWL | ACC UCL | PREC MEAN | PREC UWL | PREC UCL |
| 11 | AG | 1078 | UGG | 86.35 | 87.58 | 90.05 | 92.51 | 93.74 | 1.96 | 4.93 | 6.41 |
| 11 | AL | 1108 | UGG | | | | | | | | |
| 11 | B | 99222 | UGG | | | | | | | | |
| 11 | BA | 1008 | UGG | | | | | | | | |
| 11 | BE | 1013 | UGG | 93.11 | 94.20 | 96.37 | 98.54 | 99.63 | 1.73 | 4.35 | 5.66 |
| 11 | CA | 917 | UGG | | | | | | | | |
| 11 | CD | 1028 | UGG | 90.16 | 91.12 | 93.05 | 94.98 | 95.95 | 1.54 | 3.86 | 5.03 |
| 11 | CO | 1038 | UGG | | | | | | | | |
| 11 | CR | 1029 | UGG | 92.95 | 93.71 | 95.25 | 96.78 | 97.54 | 1.22 | 3.07 | 3.99 |
| 11 | CU | 1043 | UGG | 92.77 | 93.65 | 95.41 | 97.16 | 98.04 | 1.40 | 3.52 | 4.58 |
| 11 | FE | 1170 | UGG | | | | | | | | |
| 11 | K | 938 | UGG | | | | | | | | |
| 11 | MG | 924 | UGG | | | | | | | | |
| 11 | MN | 1053 | UGG | | | | | | | | |
| 11 | MO | 99224 | UGG | | | | | | | | |
| 11 | NA | 934 | UGG | | | | | | | | |
| 11 | NI | 1068 | UGG | 88.81 | 89.56 | 91.08 | 92.59 | 93.35 | 1.20 | 3.03 | 3.94 |
| 11 | PB | 1052 | UGG | | | | | | | | |
| 11 | SB | 1098 | UGG | | | | | | | | |
| 11 | SE | 1148 | UGG | | | | | | | | |
| 11 | TL | 34480 | UGG | 86.26 | 87.43 | 89.77 | 92.10 | 93.27 | 1.86 | 4.68 | 6.09 |
| 11 | V | 1088 | UGG | | | | | | | | |
| 11 | ZN | 1093 | UGG | 91.45 | 92.17 | 93.60 | 95.04 | 95.76 | 1.14 | 2.88 | 3.74 |

METHODS TABLE FOR METALS ANALYZED BY WATER ICAP METHOD - CURRENT STANDARD MATRIX SPIKE CONTROL LIMITS 17:02:19 22 SEP 1990

| TST NM | STORET | UNIT | CERTREPLIM | MAXIMUM CON | ACCURACY | OCT | LOW SPIKE 3 DAY MOVING ACCURACY LIMITS MAA LCL | MAA LWL | MAA MEAN | MAA UWL | MAA UCL | PRECISION LIMITS MAP MEAN | MAP UWL | MAP UCL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AG | 1077 | UGL | 4.600000 | 2500.0000 | 0.98900 | N | | | | | | | | |
| AL | 1105 | UGL | 141.000000 | 45000.0000 | 0.89100 | N | | | | | | | | |
| B | 1022 | UGL | 50.000000 | 50000.0000 | 0.88000 | N | | | | | | | | |
| BA | 1007 | UGL | 5.000000 | 10000.0000 | 1.08000 | Y | 89.24 | 95.66 | 108.48 | 121.31 | 127.72 | 18.80 | 38.55 | 48.43 |
| BE | 1012 | UGL | 5.000000 | 1000.0000 | 0.89300 | N | 71.65 | 75.55 | 83.35 | 91.14 | 95.04 | 11.43 | 23.43 | 29.44 |
| BI | | UGL | 109.000000 | 25000.0000 | 1.02000 | N | | | | | | | | |
| CA | 82032 | UGL | 500.000000 | 20000.0000 | 0.97400 | Y | 82.88 | 90.68 | 106.27 | 121.86 | 129.65 | 22.86 | 46.86 | 58.86 |
| CD | 1027 | UGL | 4.010000 | 5000.0000 | 1.00000 | Y | 86.43 | 90.63 | 99.04 | 107.44 | 111.64 | 12.32 | 25.25 | 31.72 |
| CO | 1037 | UGL | 25.000000 | 50000.0000 | 0.87900 | Y | 89.76 | 93.00 | 99.50 | 106.00 | 109.24 | 9.52 | 19.52 | 24.52 |
| CR | 1034 | UGL | 6.020000 | 5000.0000 | 1.01000 | Y | 79.56 | 87.65 | 103.83 | 120.01 | 128.10 | 23.72 | 48.63 | 61.09 |
| CU | 1042 | UGL | 8.090000 | 10000.0000 | 0.98500 | Y | 74.82 | 84.41 | 103.60 | 122.78 | 132.38 | 28.13 | 57.67 | 72.44 |
| FE | 1045 | UGL | 42.700000 | 500000.0000 | 0.90700 | N | | | | | | | | |
| K | 82034 | UGL | 375.000000 | 12500.0000 | 0.88100 | N | | | | | | | | |
| MG | 82033 | UGL | 500.000000 | 20000.0000 | 0.98800 | Y | 90.95 | 94.84 | 102.60 | 110.37 | 114.25 | 11.38 | 23.33 | 29.31 |
| MN | 1055 | UGL | 2.750000 | 2000.0000 | 0.93400 | Y | 81.78 | 88.46 | 101.83 | 115.19 | 121.87 | 19.59 | 40.16 | 50.45 |
| MO | 1062 | UGL | 15.300000 | 8000.0000 | 0.88300 | N | | | | | | | | |
| NA | 82035 | UGL | 500.000000 | 50000.0000 | 0.95400 | Y | 90.41 | 96.23 | 107.87 | 119.52 | 125.34 | 17.07 | 34.99 | 43.96 |
| NI | 1067 | UGL | 34.300000 | 15000.0000 | 0.86000 | Y | 78.30 | 84.47 | 96.82 | 109.16 | 115.33 | 18.10 | 37.10 | 46.60 |
| PB | 1051 | UGL | 18.600000 | 5000.0000 | 0.94500 | N | | | | | | | | |
| SB | 1097 | UGL | 38.000000 | 6000.0000 | 0.84400 | N | 56.89 | 65.95 | 84.08 | 102.21 | 111.28 | 26.58 | 54.49 | 68.45 |
| SE | 1147 | UGL | 71.100000 | 75000.0000 | 0.92800 | N | | | | | | | | |
| SN | | UGL | 47.100000 | 200.0000 | 1.00000 | N | | | | | | | | |
| TE | | UGL | 103.000000 | 2000.0000 | 0.99400 | N | | | | | | | | |
| TL | 1059 | UGL | 81.400000 | 40000.0000 | 0.85700 | N | | | | | | | | |
| V | 1087 | UGL | 11.000000 | 1000.0000 | 0.95800 | N | | | | | | | | |
| ZN | 1092 | UGL | 21.100000 | 20000.0000 | 0.94900 | Y | 90.44 | 97.39 | 111.30 | 125.21 | 132.16 | 20.39 | 41.80 | 52.50 |

| TST NM | STORET | UNIT | REPLICATE HIGH SPIKE ACCURACY LIMITS ACC LCL | ACC LWL | ACC MEAN | ACC UWL | ACC UCL | PRECISION LIMITS PREC MEAN | PREC UWL | PREC UCL |
|---|---|---|---|---|---|---|---|---|---|---|
| AG | 1077 | UGL | | | | | | | | |
| AL | 1105 | UGL | | | | | | | | |
| B | 1022 | UGL | | | | | | | | |
| BA | 1007 | UGL | 94.45 | 95.55 | 97.75 | 99.95 | 101.04 | 1.75 | 4.40 | 5.72 |
| BE | 1012 | UGL | 93.44 | 94.13 | 95.51 | 96.89 | 97.58 | 1.10 | 2.76 | 3.59 |
| CA | 82032 | UGL | 95.56 | 97.27 | 100.69 | 104.11 | 105.82 | 2.73 | 6.85 | 8.91 |
| CD | 1027 | UGL | 92.61 | 93.90 | 96.49 | 99.07 | 100.36 | 2.06 | 5.17 | 6.73 |
| CO | 1037 | UGL | 91.07 | 92.17 | 94.38 | 96.59 | 97.69 | 1.76 | 4.42 | 5.74 |
| CR | 1034 | UGL | 94.72 | 95.88 | 98.21 | 100.54 | 101.70 | 1.85 | 4.66 | 6.06 |
| CU | 1042 | UGL | 93.39 | 94.39 | 96.40 | 98.40 | 99.41 | 1.60 | 4.02 | 5.23 |
| FE | 1045 | UGL | | | | | | | | |
| K | 82034 | UGL | | | | | | | | |
| MG | 82033 | UGL | 94.20 | 95.78 | 98.93 | 102.08 | 103.66 | 2.51 | 6.31 | 8.21 |
| MN | 1055 | UGL | 94.35 | 95.22 | 96.97 | 98.71 | 99.59 | 1.39 | 3.49 | 4.54 |
| MO | 1062 | UGL | | | | | | | | |
| NA | 82035 | UGL | 89.70 | 91.81 | 96.05 | 100.29 | 102.40 | 3.38 | 8.48 | 11.04 |
| NI | 1067 | UGL | 90.89 | 91.85 | 93.78 | 95.71 | 96.67 | 1.53 | 3.86 | 5.02 |
| PB | 1051 | UGL | | | | | | | | |
| SB | 1097 | UGL | 86.97 | 88.74 | 92.30 | 95.85 | 97.62 | 2.83 | 7.11 | 9.25 |
| SE | 1147 | UGL | | | | | | | | |
| SN | | UGL | | | | | | | | |
| TL | 10 | | | | | | | | | |

METHODS TABLE SUMMARIZING CURRENT CONTROL LIMITS FOR THE VOA AND SVOA GCMS METHODS IN WATER AND SOIL    PREPARED: 17:41:06 22 SEP 1990

| | | | | | | | HIGH SPIKE 3 DAY MOVING AVERAGE ACCURACY | | | | | PRECISION LIMITS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TST NM | STORET PARAMETER NAME | UNIT | CERTREPLIM | MAXIMUM CON | ACCURACY | OCT | MAA LCL | MAA LWL | MAA MEAN | MAA UWL | MAA UCL | MAP MEAN | MAP UWL | MAP UCL |
| 246TBP | 97770 2,4,6-TRIBROMOPHENOL | UGG | .380000 | 13.0000 | 0.91000 | Y | 78.14 | 83.65 | 94.66 | 105.68 | 111.19 | 16.15 | 33.11 | 41.59 |
| 2FBP | 98814 FLUORBIPHENYL | UGG | .021000 | 6.7000 | 0.90300 | Y | 71.71 | 76.43 | 85.87 | 95.30 | 100.02 | 13.83 | 28.36 | 35.63 |
| 2FP | 97024 2-FLUOROPHENOL | UGG | .170000 | 13.0000 | 0.74400 | Y | 62.23 | 66.62 | 75.42 | 84.21 | 88.61 | 12.89 | 26.43 | 33.20 |
| NBD5 | 97022 NITROBENZENE-D(5) | UGG | .025000 | 6.7000 | 0.85800 | Y | 71.28 | 76.14 | 85.86 | 95.59 | 100.45 | 14.25 | 29.22 | 36.70 |
| PHEND6 | 97023 PHENOL-D(5) | UGG | .230000 | 13.0000 | 0.82400 | Y | 67.81 | 72.73 | 82.57 | 92.41 | 97.33 | 14.42 | 29.57 | 37.15 |
| TRPD14 | 98808 TERPHENYL-D(14) | UGG | .340000 | 6.7000 | 1.07000 | Y | 82.47 | 87.44 | 97.39 | 107.33 | 112.30 | 14.57 | 29.88 | 37.53 |
| 12DCD4 | 98677 1,2-DICHLOROETHENE -D4 | UGG | .003200 | .2000 | 0.99500 | Y | 89.53 | 91.72 | 96.09 | 100.46 | 102.65 | 6.41 | 13.14 | 16.51 |
| 4BFB | 98402 4-BROMOFLUOROBENZE,T | UGG | .002900 | .2000 | 0.92400 | Y | 93.25 | 95.51 | 100.04 | 104.56 | 106.82 | 6.62 | 13.58 | 17.06 |
| MEC6D8 | 98811 TOLUENE-D(8) | UGG | .001500 | .2000 | 0.99900 | Y | 92.67 | 94.98 | 99.61 | 104.23 | 106.54 | 6.78 | 13.89 | 17.45 |
| 246TBP | 97446 2,4,6-TRIBROMOPHENOL | UGL | 13.000000 | 200.0000 | 1.26000 | Y | 71.51 | 77.51 | 89.50 | 101.49 | 107.48 | 17.58 | 36.04 | 45.27 |
| 2FBP | 98321 2-FLUORBIPHENYL | UGL | 12.000000 | 100.0000 | 0.89100 | Y | 67.98 | 72.91 | 82.77 | 92.64 | 97.57 | 14.45 | 29.64 | 37.23 |
| 2FP | 98316 2-FLUOROPHENOL | UGL | 17.000000 | 200.0000 | 0.65700 | Y | 52.44 | 56.99 | 66.10 | 75.20 | 79.75 | 13.34 | 27.35 | 34.36 |
| NBD5 | 98318 NITROBENZENE-D(5) | UGL | 11.000000 | 100.0000 | 0.84500 | Y | 67.76 | 73.00 | 83.49 | 93.98 | 99.22 | 15.37 | 31.52 | 39.59 |
| PHEND6 | 98317 PHENOL-D(5) | UGL | 36.000000 | 200.0000 | 0.50000 | Y | 40.05 | 43.36 | 49.98 | 56.60 | 59.91 | 9.70 | 19.89 | 24.99 |
| TRPD14 | 97447 TERPHENYL-(D14) | UGL | 14.000000 | 100.0000 | 0.87800 | Y | 76.82 | 82.45 | 93.71 | 104.98 | 110.61 | 16.51 | 33.86 | 42.53 |
| 12DCD4 | 98053 1,2-DICHLOROETHANE-D4 | UGL | 23.000000 | 200.0000 | 0.88100 | Y | 88.05 | 90.68 | 95.95 | 101.23 | 103.86 | 7.72 | 15.84 | 19.90 |
| 4BFB | 97735 4-BROMOFLUOROBENZENE | UGL | 6.500000 | 200.0000 | 1.11000 | Y | 90.54 | 93.58 | 99.66 | 105.74 | 108.78 | 8.91 | 18.27 | 22.95 |
| MEC6D8 | 98810 TOLUENE-D(8) | UGL | .500000 | 200.0000 | 1.06000 | Y | 90.60 | 93.68 | 99.84 | 106.00 | 109.08 | 9.03 | 18.52 | 23.26 |

METHODS TABLE SUMMARIZING CURRENT CONTROL LIMITS FOR VARIOUS INORGANIC METHODS IN WATER AND SOIL

PREPARED: 17:41:06 22 SEP 1990

| | | | | | | | | LOW SPIKE 3 DAY MOVING ACCURACY LIMITS | | | | | PRECISION LIMITS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TST NM | STORET | PARAMETER NAME | UNIT | CERTREPLIM | MAXIMUM CON | ACCURACY OCT | | MAA LCL | MAA LWL | MAA MEAN | MAA UWL | MAA UCL | MAP MEAN | MAP UWL | MAP UCL |
| PHENLC | 32730 | PHENOLS, TOTAL | UGL | 7.120000 | 50.0000 | 0.87000 | Y | 77.06 | 83.53 | 96.47 | 109.41 | 115.88 | 18.97 | 38.89 | 48.86 |
| CRHEX | 1032 | CHROMIUM, (+6) | UGL | 2.500000 | 50.0000 | 0.99400 | Y | | | | | | | | |
| NIT | 633 | NITROG, NO2+NO3, SED | UGG | .600000 | 12.0000 | 1.08000 | Y | 62.56 | 72.07 | 91.10 | 110.12 | 119.63 | 27.89 | 57.18 | 71 82 |
| TPO4 | 668 | PHOSPHORUS | UGG | 7.490000 | 100.0000 | 0.95300 | Y | | | | | | | | |
| BR | 97939 | BROMIDE | UGG | 5.000000 | 200.0000 | 0.95700 | Y | | | | | | | | |
| CL | 99120 | CHLORIDE, SED | UGG | 6.050000 | 204.0000 | 0.99400 | Y | 76.63 | 83.09 | 96.01 | 108.94 | 115.40 | 18.95 | 38.84 | 48.79 |
| F | 949 | FLUORIDE, SED | UGG | 3.620000 | 51.2000 | 0.87100 | Y | | | | | | | | |
| SO4 | 81612 | SULFATE, SED. | UGG | 90.400000 | 512.0000 | 0.90400 | Y | 90.04 | 93.34 | 99.95 | 106.56 | 109.87 | 9.69 | 19.86 | 24.95 |
| CYN | 721 | CYANIDE | UGG | .920000 | 10.0000 | 0.92400 | Y | 86.13 | 91.59 | 102.52 | 113.45 | 118.91 | 16.02 | 32.84 | 41.25 |
| CYN | 99315 | CYANIDE | UGL | 2.500000 | 50.0000 | 1.00000 | Y | 88.77 | 92.12 | 98.84 | 105.55 | 108.91 | 9.84 | 20.18 | 25.35 |
| PO4ORT | 96161 | PHOSPHORUS, DISS-ORTHO | UGL | 11.000000 | 500.0000 | 1.00000 | Y | 91.94 | 94.96 | 101.00 | 107.04 | 110.06 | 8.85 | 18.15 | 22.80 |
| NIT | 98582 | NITROGEN, NO2+NO3 | UGL | 10.000000 | 200.0000 | 0.99900 | Y | 93.50 | 95.25 | 98.76 | 102.27 | 104.03 | 5.14 | 10.54 | 13.24 |
| NH3 | 96159 | NITROGEN, NH3+NH4 | UGL | 60.000000 | 1000.0000 | 1.10000 | Y | 120.90 | 122.27 | 125.00 | 127.72 | 129.09 | 4.00 | 8.20 | 10.30 |
| N2KJEL | 96158 | NITROGEN, TKN | UGL | 183.000000 | 5000.0000 | 1.05000 | Y | | | | | | | | |
| PO4 | 96157 | PHOSPHORUS, TOTAL | UGL | 13.300000 | 500.0000 | 1.01000 | Y | | | | | | | | |
| BR | 71870 | BROMIDE | UGL | 1000.000000 | 25000.0000 | 1.03000 | Y | 74.78 | 78.45 | 85.81 | 93.17 | 96.84 | 10.78 | 22.11 | 27.77 |
| CL | 98555 | CHLORIDE | UGL | 2120.000000 | 30000.0000 | 0.91100 | Y | 78.62 | 83.36 | 92.85 | 102.33 | 107.08 | 13.91 | 28.51 | 35.81 |
| F | 98556 | FLUORIDE | UGL | 1230.000000 | 10000.0000 | 1.03000 | Y | 79.75 | 85.17 | 95.99 | 106.81 | 112.22 | 15.86 | 32.52 | 40.85 |
| SO4 | 98581 | SULFATE | UGL | 10000.000000 | 300000.0000 | 1.00000 | Y | 89.66 | 91.48 | 95.11 | 98.73 | 100.55 | 5.32 | 10.90 | 13.69 |
| SULFID | | | UGL | 32.027000 | 750.0000 | 1.00000 | N | | | | | | | | |

| | | | REPLICATE HIGH SPIKE ACCURACY LIMITS | | | | | PRECISION LIMTS | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TST NM | STORET | UNIT | ACC LCL | ACC LWL | ACC MEAN | ACC UWL | ACC UCL | PREC MEAN | PREC UWL | PREC UCL |
| PHENLC | 32730 | UGL | 93.47 | 94.57 | 96.77 | 98.97 | 100.07 | 1.75 | 4.40 | 5.73 |
| CRHEX | 1032 | UGL | | | | | | | | |
| NIT | 633 | UGG | 83.59 | 87.22 | 94.46 | 101.70 | 105.33 | 5.78 | 14.51 | 18.88 |
| TPO4 | 668 | UGG | | | | | | | | |
| BR | 97939 | UGG | | | | | | | | |
| CL | 99120 | UGG | 87.67 | 89.25 | 92.40 | 95.56 | 97.13 | 2.51 | 6.32 | 8.22 |
| F | 949 | UGG | | | | | | | | |
| SO4 | 81612 | UGG | 89.03 | 90.70 | 92.44 | 94.18 | 95.05 | 1.38 | 3.48 | 4.53 |
| CYN | 721 | UGG | 96.40 | 97.53 | 99.79 | 102.05 | 103.19 | 1.80 | 4.53 | 5.89 |
| CYN | 99315 | UGL | 92.98 | 94.31 | 96.96 | 99.62 | 100.94 | 2.11 | 5.31 | 6.91 |
| PO4ORT | 96161 | UGL | 98.85 | 99.53 | 100.88 | 102.24 | 102.92 | 1.08 | 2.71 | 3.53 |
| NIT | 98582 | UGL | 98.10 | 98.72 | 99.95 | 101.17 | 101.79 | .98 | 2.46 | 3.20 |
| NH3 | 96159 | UGL | 96.77 | 98.60 | 102.26 | 105.91 | 107.74 | 2.92 | 7.33 | 9.53 |
| N2KJEL | 96158 | UGL | | | | | | | | |
| PO4 | 96157 | UGL | | | | | | | | |
| BR | 71870 | UGL | 100.68 | 101.62 | 103.50 | 105.38 | 106.32 | 1.50 | 3.76 | 4.90 |
| CL | 98555 | UGL | 94.93 | 96.46 | 99.52 | 102.58 | 104.11 | 2.44 | 6.12 | 7.97 |
| F | 98556 | UGL | 89.94 | 91.59 | 94.89 | 98.19 | 99.84 | 2.63 | 6.61 | 8.60 |
| SO4 | 98581 | UGL | 99.56 | 99.78 | 100.22 | 100.66 | 100.88 | .35 | .87 | 1.14 |

METHODS TABLE SUMMARIZING CURRENT CONTROL LIMITS FOR GC VOA METHODS IN WATER

17:41:06 22 SEP 1990

| TST NM | STORET | PARAMETER NAME | UNIT | CERTREPLIM | MAXIMUM CON | ACCURACY OCT | LOW SPIKE 3 DAY MOVING ACCURACY LIMITS | | | | | PRECISION LIMITS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | MAA LCL | MAA LWL | MAA MEAN | MAA UWL | MAA UCL | MAP MEAN | MAP UWL | MAP UCL |
| 111TCE | 34506 | 1,1,1-TRICHL'ETHANE | UGL | 2.900000 | 50.0000 | 1.08000 Y | 85.29 | 90.95 | 102.28 | 113.60 | 119.27 | 16.60 | 34.04 | 42.75 |
| 112TCE | 34511 | 1,1,2-TRICHLOROETHANE | UGL | .332000 | 49.0000 | 1.10000 N | | | | | | | | |
| 11DCE | 34501 | 1,1-DICHLOROETHYLENE | UGL | .393000 | 51.0000 | 1.06000 Y | 81.46 | 85.49 | 93.55 | 101.61 | 105.64 | 11.82 | 24.23 | 30.43 |
| 11DCLE | 34496 | 1,1-DICHLOROETHANE | UGL | .334000 | 49.5000 | 1.03000 N | | | | | | | | |
| 12DCLE | 34531 | 1,2-DICHLOROETHANE | UGL | 2.950000 | 49.0000 | 1.08000 N | | | | | | | | |
| 12DCLP | 34541 | 1,2-DICHLOROPROPANE | UGL | 3.160000 | 49.0000 | 1.09000 N | | | | | | | | |
| 13DCLB | 34566 | 1,3,DICHLOROBENZENE | UGL | 1.340000 | 50.0000 | 0.92100 Y | | | | | | | | |
| 13DMB | 98553 | M-XYLENE | UGL | 1.560000 | 49.5000 | 1.00000 Y | | | | | | | | |
| 2CLEVE | 34576 | 2-CHLOROETHYLVINYL ETHER | UGL | 22.100000 | 49.5000 | 1.11000 N | | | | | | | | |
| BRDCLM | 32101 | BROMODICHLOROMETHANE | UGL | 3.060000 | 50.5000 | 1.11000 N | | | | | | | | |
| C13DCP | 34704 | CIS-1,3-DICHLORO PROPENE | UGL | 3.230000 | 48.5000 | 1.08000 N | | | | | | | | |
| C2H3CL | 39175 | VINYL CHLORIDE | UGL | 2.070000 | 50.0000 | 1.16000 Y | | | | | | | | |
| C2H5CL | 34311 | CHLOROETHANE | UGL | 1.600000 | 50.0000 | 1.24000 N | | | | | | | | |
| C6H6 | 34030 | BENZENE | UGL | .651000 | 49.0000 | 1.07000 Y | 82.75 | 86.47 | 93.91 | 101.35 | 105.07 | 10.91 | 22.36 | 28.09 |
| CCL2F2 | 34668 | DICHLORODIFLUORO METHANE | UGL | 2.040000 | 50.0000 | 1.25000 Y | | | | | | | | |
| CCL3F | 34488 | TRICHL'FLUOROMETHANE | UGL | .503000 | 51.5000 | 1.06000 Y | | | | | | | | |
| CCL4 | 32102 | CARBON TETRACHLORIDE | UGL | 2.810000 | 49.0000 | 1.03000 Y | | | | | | | | |
| CH2CL2 | 34423 | METHYLENE CHLORIDE | UGL | 3.100000 | 49.0000 | 1.05000 N | | | | | | | | |
| CH3BR | 34413 | BROMOMETHANE | UGL | 2.680000 | 50.0000 | 1.20000 Y | | | | | | | | |
| CH3CL | 34418 | CHLOROMETHANE | UGL | 1.980000 | 50.0000 | 1.04000 Y | | | | | | | | |
| CHBR3 | 32104 | BROMOFORM | UGL | 4.030000 | 52.0000 | 1.06000 Y | | | | | | | | |
| CHCL3 | 32106 | CHLOROFORM | UGL | 1.260000 | 50.0000 | 1.05000 N | 74.63 | 80.26 | 91.53 | 102.80 | 108.43 | 16.52 | 33.86 | 42.53 |
| CL2BZ | 97630 | O,P-DICHLOROBENZENE | UGL | 6.220000 | 111.0000 | 0.99400 N | | | | | | | | |
| CLC6H5 | 34301 | CHLOROBENZENE | UGL | .582000 | 50.5000 | 0.98800 Y | 86.29 | 89.04 | 94.55 | 100.06 | 102.81 | 8.07 | 16.55 | 20.79 |
| DBRCLM | 32105 | DIBROMOCHLOROMETHANE | UGL | .352000 | 51.5000 | 1.10000 N | | | | | | | | |
| ETC6H5 | 34371 | ETHYLBENZENE | UGL | .857000 | 49.5000 | 0.99900 Y | 88.17 | 91.62 | 98.52 | 105.42 | 108.87 | 10.11 | 20.73 | 26.04 |
| MEC6H5 | 34010 | TOLUENE | UGL | .716000 | 49.5000 | 1.04000 N | 88.97 | 92.14 | 98.48 | 104.83 | 108.00 | 9.30 | 19.06 | 23.94 |
| T12DCE | 34546 | T-1,2-DICHLOROETHENE | UGL | .427000 | 49.0000 | 1.04000 N | | | | | | | | |
| T13DCP | 34699 | TRANS-1,3-DICHLORO PROPENE | UGL | .326000 | 49.5000 | 1.10000 Y | | | | | | | | |
| TCLEA | 34516 | 1,1,2,2-TETRACHLORO ETHANE | UGL | 1.090000 | 52.0000 | 0.95300 N | | | | | | | | |
| TCLEE | 34475 | TETRACHLOROETHENE | UGL | .677000 | 51.0000 | 0.99600 Y | 83.13 | 87.44 | 96.05 | 104.66 | 108.97 | 12.63 | 25.89 | 32.52 |
| TRCLE | 39180 | TRICHLOROETHENE | UGL | 3.590000 | 50.0000 | 1.05000 Y | 74.57 | 81.17 | 94.37 | 107.57 | 114.17 | 19.35 | 39.67 | 49.83 |
| XYLEN | 98554 | O-AND/OR-P XYLENE | UGL | 1.730000 | 102.0000 | 0.99500 Y | | | | | | | | |

| TST NM | STORET | UNIT | REPLICATE HIGH SPIKE ACCURACY LIMITS | | | | | PRECISION LIMTS | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ACC LCL | ACC LWL | ACC MEAN | ACC UWL | ACC UCL | PREC MEAN | PREC UWL | PREC UCL |
| 111TCE | 34506 | UGL | 85.19 | 90.04 | 99.75 | 109.45 | 114.31 | 7.74 | 19.45 | 25.30 |
| 11DCE | 34501 | UGL | 80.32 | 84.63 | 93.27 | 101.91 | 106.22 | 6.89 | 17.30 | 22.50 |
| C6H6 | 34030 | UGL | 85.76 | 88.67 | 94.50 | 100.33 | 103.24 | 4.65 | 11.67 | 15.19 |
| CHCL3 | 32106 | UGL | 80.73 | 84.77 | 92.84 | 100.92 | 104.96 | 6.44 | 16.18 | 21.05 |
| CLC6H5 | 34301 | UGL | 89.04 | 90.98 | 94.87 | 98.75 | 100.69 | 3.10 | 7.78 | 10.12 |
| ETC6H5 | 34371 | UGL | 95.05 | 96.69 | 99.96 | 103.24 | 104.88 | 2.61 | 6.56 | 8.54 |
| MEC6H5 | 34010 | UGL | 91.53 | 93.76 | 98.22 | 102.68 | 104.91 | 3.56 | 8.94 | 11.63 |
| TCLEE | 34475 | UGL | 88.57 | 91.09 | 96.13 | 101.18 | 103.70 | 4.02 | 10.10 | 13.14 |
| TRCLE | 39180 | UGL | 82.16 | 85.22 | 91.35 | 97.48 | 100.54 | 4.89 | 12.28 | 15.97 |

METHODS TABLE SUMMARIZING CURRENT CONTROL LIMITS GC VOA METHODS IN SOIL

17:41:06 22 SEP 1990

| TST NM | STORET | PARAMETER NAME | UNIT | CERTREPLIM | MAXIMUM CON | ACCURACY | OCT | LOW SPIKE 3 DAY MOVING ACCURACY LIMITS MAA LCL | MAA LWL | MAA MEAN | MAA UWL | MAA UCL | PRECISION LIMITS MAP MEAN | MAP UWL | MAP UCL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 111TCE | 98692 | 1,1,1-TRICHLOROETHANE | UGG | .040000 | 5.0000 | 0.98800 | Y | 86.21 | 88.82 | 94.03 | 99.24 | 101.85 | 7.64 | 15.66 | 19.67 |
| 112TCE | 986[illegible] | 1,1,2-TRICHLOROETHANE | UGG | .081000 | 5.0000 | 0.95700 | Y | | | | | | | | |
| 11DCE | 98789 | 1,1-DICHLOROETHENE | UGG | .051000 | 5.0000 | 0.94100 | Y | 80.52 | 82.61 | 86.78 | 90.96 | 93.05 | 6.12 | 12.55 | 15.77 |
| 11DCLE | 98683 | 1,1-DICHLOROETHANE | UGG | .055000 | 5.0000 | 0.94800 | Y | | | | | | | | |
| 12DCLE | 98684 | 1,2-DIC[illegible] | UGG | .071[illegible] | 5.0000 | 0.90200 | Y | | | | | | | | |
| 12DCLP | 98790 | 1,2-DICHLO[illegible]ANE | UGG | .043000 | 5.0000 | 1.00000 | Y | | | | | | | | |
| 13DCLB | 99468 | 1,3-DICHLOROBENZENE | UGG | .032000 | 5.0000 | 1.01000 | Y | | | | | | | | |
| 13DMB | 98799 | M-XYLENE | UGG | .056000 | 5.0000 | 1.01000 | Y | | | | | | | | |
| 2CLEVE | 98796 | 2-CHLOROETHYLVINYLETHER | UGG | .075000 | 5.0000 | 0.79900 | Y | | | | | | | | |
| BRDCLM | 98783 | BROMODICHLOROMETHANE | UGG | .047000 | 5.0000 | 0.92100 | Y | | | | | | | | |
| C13DCP | 98791 | CIS-1,3-DICHLOROPROPENE | UGG | .062000 | 5.0000 | 0.86000 | Y | | | | | | | | |
| C2H3CL | 98795 | VINYL CHLORIDE | UGG | .031000 | 5.0000 | 0.92100 | Y | | | | | | | | |
| C2H5CL | 98786 | CHLOROETHANE | UGG | .029000 | 5.0000 | 0.96100 | Y | | | | | | | | |
| C6H6 | 98699 | BENZENE | UGG | .085000 | 5.0000 | 0.95200 | Y | 81.68 | 85.14 | 92.06 | 98.98 | 102.44 | 10.14 | 20.79 | 26.12 |
| CCL2F2 | 97015 | DICHLORODIFLUOROMETHANE,S,UG/G- | UGG | .032000 | 5.0000 | 0.92100 | N | | | | | | | | |
| CCL3F | 98794 | TRICHLOROFLUOROMETHANE | UGG | .037000 | 5.0000 | 0.92900 | N | | | | | | | | |
| CCL4 | 98680 | CARBON TETRACHLORIDE | UGG | .044000 | 5.0000 | 0.96500 | Y | | | | | | | | |
| CH2CL2 | 98689 | METHYLENE CHLORIDE | UGG | .083000 | 5.0000 | 0.95600 | Y | | | | | | | | |
| CH3BR | 98785 | BROMOMETHANE | UGG | .031000 | 5.0000 | 0.89900 | Y | | | | | | | | |
| CH3CL | 98787 | CHLOROMETHANE | UGG | .180000 | 5.0000 | 0.93300 | Y | | | | | | | | |
| CHBR3 | 98784 | BROMOFORM | UGG | .031000 | 5.0000 | 0.85600 | Y | | | | | | | | |
| CHCL3 | 98682 | CHLOROFORM | UGG | .038000 | 5.0000 | 0.96900 | Y | 69.15 | 72.09 | 77.98 | 83.87 | 86.81 | 8.63 | 17.69 | 22.23 |
| CL2BZ | 96032 | O,P-DICHLOROBENZENE | UGG | .060000 | 10.0000 | 0.99800 | Y | | | | | | | | |
| CLC6H5 | 98681 | CHLOROBENZENE | UGG | .026000 | 5.0000 | 0.92500 | Y | 87.30 | 89.80 | 94.79 | 99.78 | 102.28 | 7.32 | 15.00 | 18.84 |
| DBRCLM | 98788 | DIBROMOCHLOROMETHANE | UGG | .081000 | 5.0000 | 0.95700 | Y | | | | | | | | |
| ETC6H5 | 98688 | ETHYLBENZENE | UGG | .062000 | 5.0000 | 1.03000 | Y | 91.77 | 95.08 | 101.69 | 108.30 | 111.61 | 9.69 | 19.87 | 24.96 |
| MEC6H5 | 98691 | TOLUENE | UGG | .028000 | 5.0000 | 0.97000 | Y | 89.68 | 91.70 | 95.74 | 99.79 | 101.81 | 5.92 | 12.14 | 15.26 |
| T12DCE | 98687 | TRANS-1,2-DICHLOROETHENE | UGG | .063000 | 5.0000 | 0.94800 | N | | | | | | | | |
| T13DCP | 98792 | TRANS-1,3-DICHLOROPROPENE | UGG | .081000 | 5.0000 | 0.95700 | Y | | | | | | | | |
| TCLEA | 98793 | 1,1,2,2-TETRACHLOROETHANE | UGG | .045000 | 5.0000 | 0.90600 | Y | | | | | | | | |
| TCLEE | 98690 | TETRACHLOROETHENE | UGG | .045000 | 5.0000 | 0.90600 | Y | 81.92 | 84.82 | 90.62 | 96.42 | 99.32 | 8.50 | 17.42 | 21.88 |
| TRCLE | 98694 | TRICHLOROETHENE | UGG | .049000 | 5.0000 | 0.97200 | Y | 80.61 | 82.90 | 87.49 | 92.07 | 94.37 | 6.72 | 13.78 | 17.31 |
| XYLEN | 98800 | O,P-XYLENE | UGG | .086000 | 10.0000 | 1.01000 | Y | | | | | | | | |

| TST NM | STORET | UNIT | REPLICATE HIGH SPIKE ACCURACY LIMITS ACC LCL | ACC LWL | ACC MEAN | ACC UWL | ACC UCL | PRECISION LIMTS PREC MEAN | PREC UWL | PREC UCL |
|---|---|---|---|---|---|---|---|---|---|---|
| 111TCE | 98692 | UGG | 88.27 | 91.02 | 96.50 | 101.98 | 104.72 | 4.37 | 10.98 | 14.29 |
| 11DCE | 98789 | UGG | 78.79 | 82.18 | 88.95 | 95.71 | 99.10 | 5.40 | 13.56 | 17.64 |
| C6H6 | 98699 | UGG | 85.89 | 88.16 | 92.70 | 97.24 | 99.50 | 3.62 | 9.09 | 11.82 |
| CHCL3 | 98682 | UGG | 79.99 | 82.96 | 88.91 | 94.85 | 97.82 | 4.74 | 11.90 | 15.48 |
| CLC6H5 | 98681 | UGG | 90.07 | 92.99 | 98.83 | 104.67 | 107.59 | 4.66 | 11.70 | 15.22 |
| ETC6H5 | 98688 | UGG | 103.98 | 106.03 | 110.14 | 114.25 | 116.31 | 3.27 | 8.23 | 10.71 |
| MEC6H5 | 98691 | UGG | 96.15 | 97.91 | 101.43 | 104.95 | 106.71 | 2.80 | 7.05 | 9.17 |
| TCLEE | 98690 | UGG | 83.10 | 86.85 | 94.34 | 101.83 | 105.57 | 5.97 | 15.01 | 19.52 |
| TRCLE | 98694 | UGG | 83.82 | 86.74 | 92.58 | 98.42 | 101.34 | 4.65 | 11.69 | 15.21 |

METHODS TABLE SUMMARIZING CURRENT CONTROL LIMITS FOR EXPLOSIVES METHODS IN WATER

17:41:06 22 SEP 1990

| M | TST NM | STORET | PARAMETER NAME | UNIT | CERTREPLIM | MAXIMUM CON | ACCURACY | QCT | MAA LCL | LOW SPIKE 3 DAY MOVING ACCURACY LIMITS<br>MAA LWL | MAA MEAN | MAA UWL | MAA UCL | MAP MEAN | PRECISION LIMITS<br>MAP UWL | MAP UCL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | BRMCIL | 82198 | BROMACIL | UGL | 3.830000 | 61.5000 | 0.96100 | Y | 86.85 | 91.13 | 99.70 | 108.27 | 112.56 | 12.56 | 25.75 | 32.35 |
| 4 | 135TNB | 99735 | 1,3,5-TRINITROBENZENE | UGL | .626000 | 42.1000 | 0.81700 | Y | 70.20 | 74.00 | 81.61 | 89.22 | 93.03 | 11.15 | 22.87 | 28.73 |
| 4 | 13DNB | 99724 | 1,3-DINITROBENZENE | UGL | .519000 | 40.1000 | 0.83200 | N | | | | | | | | |
| 14 | 246TNT | 81360 | 2,4,6-TRINITROTOLUENE,T | UGL | .588000 | 40.2000 | 0.85500 | Y | 70.56 | 75.24 | 84.60 | 93.96 | 98.64 | 13.72 | 28.13 | 35.34 |
| 14 | 24DNT | 34611 | 2,4-DINITROTOLUENE | UGL | .612000 | 40.2000 | 0.83500 | Y | 72.95 | 76.82 | 84.55 | 92.28 | 96.15 | 11.33 | 23.23 | 29.18 |
| 14 | 26DNT | 34626 | 2,6-DINITROTOLUENE | UGL | 1.150000 | 52.4000 | 0.76700 | N | 74.10 | 79.33 | 89.79 | 100.24 | 105.47 | 15.33 | 31.43 | 39.48 |
| 14 | HMX | 99431 | HMX | UGL | 1.650000 | 28.9000 | 0.93200 | N | | | | | | | | |
| 14 | NB | 34447 | NITROBENZENE | UGL | 1.070000 | 54.9000 | 0.79500 | Y | 71.18 | 75.15 | 83.08 | 91.02 | 94.98 | 11.63 | 23.84 | 29.95 |
| 14 | RDX | 81364 | RDX | UGL | 2.110000 | 43.9000 | 0.85100 | Y | 71.07 | 78.06 | 92.05 | 106.03 | 113.02 | 20.50 | 42.02 | 52.79 |
| 14 | TETRYL | 99733 | TETRYL,TOTAL | UGL | .556000 | 44.5000 | 0.74900 | N | | | | | | | | |
| 17 | NQ | | | UGL | 30.900000 | 620.0000 | 0.95600 | Y | | | | | | | | |
| 19 | NG | 99808 | NITROGLYCERIN(TOTAL | UGL | 10.000000 | 200.0000 | 1.04000 | Y | 74.16 | 80.33 | 92.68 | 105.03 | 111.20 | 18.10 | 37.12 | 46.62 |
| 19 | PETN | 99620 | PETN | UGL | 20.000000 | 400.0000 | 1.05000 | Y | | | | | | | | |
| 3 | NC | 99770 | NITROCELLULOSE,TOTAL | UGL | 553.000000 | 6000.0000 | 0.82600 | Y | 53.49 | 71.00 | 106.03 | 141.06 | 158.57 | 51.36 | 105.28 | 132.25 |

| M | TST NM | STORET | UNIT | REPLICATE HIGH SPIKE ACCURACY LIMITS<br>ACC LCL | ACC LWL | ACC MEAN | ACC UWL | ACC UCL | PRECISION LIMTS<br>PREC MEAN | PREC UWL | PREC UCL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | BRMCIL | 82198 | UGL | 91.10 | 93.81 | 99.24 | 104.67 | 107.38 | 4.33 | 10.87 | 14.14 |
| 14 | 135TNB | 99735 | UGL | 72.60 | 75.80 | 82.21 | 88.62 | 91.82 | 5.11 | 12.84 | 16.70 |
| 14 | 13DNB | 99724 | UGL | | | | | | | | |
| 14 | 246TNT | 81360 | UGL | 74.15 | 77.64 | 84.62 | 91.60 | 95.09 | 5.57 | 13.98 | 18.19 |
| 14 | 24DNT | 34611 | UGL | 72.90 | 76.52 | 83.75 | 90.99 | 94.60 | 5.77 | 14.49 | 18.85 |
| 14 | 26DNT | 34626 | UGL | 79.95 | 83.99 | 92.09 | 100.19 | 104.24 | 6.46 | 16.22 | 21.10 |
| 14 | HMX | 99431 | UGL | | | | | | | | |
| 14 | NB | 34447 | UGL | 71.33 | 75.05 | 82.48 | 89.90 | 93.62 | 5.92 | 14.88 | 19.36 |
| 14 | RDX | 81364 | UGL | 78.27 | 82.01 | 89.47 | 96.94 | 100.68 | 5.95 | 14.96 | 19.46 |
| 14 | TETRYL | 99733 | UGL | | | | | | | | |
| 17 | NQ | | UGL | | | | | | | | |
| 19 | NG | 99808 | UGL | 80.15 | 84.22 | 92.38 | 100.54 | 104.61 | 6.50 | 16.34 | 21.26 |
| 19 | PETN | 99620 | UGL | | | | | | | | |
| 3 | NC | 99770 | UGL | 79.61 | 83.15 | 90.24 | 97.33 | 100.87 | 5.65 | 14.20 | 18.47 |

METHODS TABLE SUMMARIZING CURRENT CONTROL LIMITS FOR EXPLOSIVES METHODS IN SOIL

17:41:06 22 SEP 1990

| TST NM | STORET | PARAMETER NAME | UNIT | CERTREPLIM | MAXIMUM CON | ACCURACY OCT | MAA LCL | LOW SPIKE 3 DAY MOVING ACCURACY LIMITS MAA LWL | MAA MEAN | MAA UWL | MAA UCL | MAP MEAN | PRECISION LIMITS MAP UWL | MAP UCL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BRMCIL | 97349 | BROMACIL, SOIL | UGG | .970000 | 20.7000 | 0.65000 Y | | | | | | | | |
| 135TNB | 98576 | 1,3,5-TNB,SOIL | UGG | .488000 | 24.4000 | 0.99100 Y | 75.55 | 79.79 | 88.26 | 96.74 | 100.98 | 12.42 | 25.47 | 31.99 |
| 13DNB | 98577 | 1,3-DINITROBENZENE | UGG | .496000 | 24.8000 | 0.95200 Y | | | | | | | | |
| 246TNT | 98574 | 2,4,6-TNT,SOIL | UGG | .456000 | 22.8000 | 1.01000 Y | 83.35 | 89.28 | 101.16 | 113.03 | 118.97 | 17.41 | 35.69 | 44.83 |
| 24DNT | 98575 | 2,4-DNT,SOIL | UGG | .424000 | 21.2000 | 0.93800 Y | 75.99 | 79.03 | 85.11 | 91.19 | 94.23 | 8.91 | 18.27 | 22.96 |
| 26DNT | 98573 | 2,6-DNT,SOIL | UGG | .524000 | 26.2000 | 0.97700 Y | | | | | | | | |
| HMX | 99817 | HMX,SOIL | UGG | .666000 | 33.3000 | 1.00000 Y | | | | | | | | |
| NB | 98774 | NITROBENZENE,SOIL | UGG | 2.410000 | 27.4000 | 0.79300 Y | 76.06 | 79.77 | 87.20 | 94.63 | 98.34 | 10.88 | 22.32 | 28.03 |
| NG | 99809 | NITROGLYCERIN,SOIL | UGG | 4.000000 | 200.0000 | 0.93100 Y | 68.73 | 75.31 | 88.48 | 101.65 | 108.23 | 19.30 | 39.58 | 49.71 |
| PETN | 99621 | PETN,SOIL | UGG | 4.000000 | 80.0000 | 0.96900 Y | 73.07 | 78.64 | 89.79 | 100.93 | 106.50 | 16.34 | 33.49 | 42.07 |
| RDX | 99795 | RDX,SOIL | UGG | .587000 | 21.9000 | 0.92900 Y | 72.44 | 76.85 | 85.67 | 94.49 | 98.90 | 12.93 | 26.51 | 33.30 |
| TETRYL | 98165 | TETRYL,SED | UGG | .731000 | 20.2000 | 1.13000 Y | | | | | | | | |
| NQ | 97795 | NITROGUANIDINE | UGG | .475000 | 9.5000 | 0.90100 Y | | | | | | | | |
| NC | 99574 | NITROCELLULOSE,SOIL | UGG | 10.400000 | 125.0000 | 0.53300 Y | 33.57 | 39.05 | 50.01 | 60.97 | 66.45 | 16.07 | 32.94 | 41.38 |

| TST NM | STORET | UNIT | REPLICATE HIGH SPIKE ACCURACY LIMITS ACC LCL | ACC LWL | ACC MEAN | ACC UWL | ACC UCL | PRECISION LIMTS PREC MEAN | PREC UWL | PREC UCL |
|---|---|---|---|---|---|---|---|---|---|---|
| BRMCIL | 97349 | UGG | | | | | | | | |
| 135TNB | 98576 | UGG | 90.14 | 91.64 | 94.63 | 97.62 | 99.12 | 2.38 | 5.99 | 7.79 |
| 13DNB | 98577 | UGG | | | | | | | | |
| 246TNT | 98574 | UGG | 100.68 | 102.22 | 105.29 | 108.36 | 109.90 | 2.45 | 6.15 | 8.00 |
| 24DNT | 98575 | UGG | 85.90 | 87.44 | 90.53 | 93.61 | 95.15 | 2.46 | 6.17 | 8.03 |
| 26DNT | 98573 | UGG | | | | | | | | |
| HMX | 99817 | UGG | | | | | | | | |
| NB | 98774 | UGG | 91.74 | 93.54 | 97.13 | 100.73 | 102.53 | 2.87 | 7.21 | 9.38 |
| NG | 99809 | UGG | 85.77 | 88.34 | 93.48 | 98.63 | 101.20 | 4.10 | 10.30 | 13.40 |
| PETN | 99621 | UGG | 80.40 | 82.47 | 86.61 | 90.74 | 92.81 | 3.30 | 8.28 | 10.78 |
| RDX | 99795 | UGG | 85.58 | 87.31 | 90.76 | 94.22 | 95.95 | 2.75 | 6.92 | 9.01 |
| TETRYL | 98165 | UGG | | | | | | | | |
| NQ | 97795 | UGG | | | | | | | | |
| NC | 99574 | UGG | 38.03 | 41.17 | 47.45 | 53.73 | 56.87 | 5.01 | 12.58 | 16.37 |

METHODS TABLE SUMMARIZING CURRENT CONTROL LIMITS OF METHODS FOR AGENT BREAKDOWN PRODUCTS IN WATER AND SOIL 17:41:06 22 SEP 1990

| | | | | | | | LOW SPIKE 3 DAY MOVING ACCURACY LIMITS | | | | | PRECISION LIMITS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TST NM | STORET | PARAMETER NAME | UNIT | CERTREPLIM | MAXIMUM CON | ACCURACY QCT | MAA LCL | MAA LWL | MAA MEAN | MAA UWL | MAA UCL | MAP MEAN | MAP UWL | MAP UCL |
| TDGCL | 99797 | THIODIGLYCOL | UGL | 187.000000 | 4880.0000 | 0.68800 Y | 61.76 | 69.87 | 86.08 | 102.28 | 110.39 | 23.76 | 48.71 | 61.19 |
| TDGCLA | | | UGL | 52.700000 | 1780.0000 | 0.93000 Y | | | | | | | | |
| CLC2A | 97285 | CHLOROACETIC ACID | UGG | 18.000000 | 302.0000 | 0.83700 Y | | | | | | | | |
| TDGCL | 99798 | THIODIGLYCOL | UGG | 3.940000 | 102.0000 | 1.07000 Y | 74.81 | 82.90 | 99.08 | 115.26 | 123.35 | 23.72 | 48.63 | 61.09 |
| DIMP | 98551 | DIMP | UGL | 10.500000 | 210.0000 | 0.91200 Y | 83.31 | 87.43 | 95.67 | 103.91 | 108.03 | 12.08 | 24.76 | 31.11 |
| DMMP | 98552 | DMMP | UGL | 15.200000 | 305.0000 | 0.96800 Y | 74.48 | 79.39 | 89.20 | 99.02 | 103.93 | 14.39 | 29.50 | 37.06 |
| FC2A | 97381 | FLUOROACETIC ACID | UGG | 2.000000 | 40.0000 | 0.92900 Y | 65.88 | 73.72 | 89.39 | 105.06 | 112.90 | 22.98 | 47.10 | 59.17 |
| IMPA | 97382 | IMPA | UGG | 2.110000 | 40.0000 | 0.92900 Y | 82.57 | 85.10 | 90.16 | 95.23 | 97.76 | 7.42 | 15.21 | 19.11 |
| MPA | 97383 | MPA | UGG | 2.000000 | 40.0000 | 0.86600 Y | 65.96 | 72.23 | 84.77 | 97.31 | 103.58 | 18.38 | 37.69 | 47.34 |
| FC2A | 97381 | FLUOROACETIC ACID | UGL | 2.000000 | 40.0000 | 0.92900 Y | 65.88 | 73.72 | 89.39 | 105.06 | 112.90 | 22.98 | 47.10 | 59.17 |
| IMPA | 97382 | IMPA | UGL | 2.110000 | 40.0000 | 0.92900 Y | 82.57 | 85.10 | 90.16 | 95.23 | 97.76 | 7.42 | 15.21 | 19.11 |
| MPA | 97383 | MPA | UGL | 2.000000 | 40.0000 | 0.86600 Y | 65.96 | 72.23 | 84.77 | 97.31 | 103.58 | 18.38 | 37.69 | 47.34 |

| | | | REPLICATE HIGH SPIKE ACCURACY LIMITS | | | | | PRECISION LIMTS | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TST NM | STORET | UNIT | ACC LCL | ACC LWL | ACC MEAN | ACC UWL | ACC UCL | PREC MEAN | PREC UWL | PREC UCL |
| FC2A | 97381 | UGG | 86.15 | 90.11 | 98.03 | 105.94 | 109.90 | 6.31 | 15.85 | 20.63 |
| IMPA | 97382 | UGG | 91.07 | 93.11 | 97.18 | 101.24 | 103.28 | 3.24 | 8.14 | 10.60 |
| MPA | 97383 | UGG | 82.83 | 84.35 | 87.38 | 90.40 | 91.92 | 2.41 | 6.06 | 7.88 |
| TDGCL | 99797 | UGL | 75.97 | 78.82 | 84.51 | 90.21 | 93.06 | 4.54 | 11.41 | 14.84 |
| TDGCLA | | UGL | | | | | | | | |
| CLC2A | 97285 | UGG | | | | | | | | |
| TDGCL | 99798 | UGG | 62.32 | 71.60 | 90.15 | 108.69 | 117.97 | 14.80 | 37.16 | 48.35 |
| DIMP | 98551 | UGL | 86.28 | 89.50 | 95.94 | 102.38 | 105.60 | 5.13 | 12.90 | 16.78 |
| DMMP | 98552 | UGL | 78.02 | 83.24 | 93.68 | 104.13 | 109.35 | 8.33 | 20.92 | 27.22 |
| DIMP | 98645 | UGG | 83.63 | 86.11 | 91.06 | 96.01 | 98.48 | 3.95 | 9.92 | 12.90 |
| DMMP | 98657 | UGG | 65.94 | 74.06 | 90.29 | 106.52 | 114.64 | 12.95 | 32.52 | 42.30 |

MY METHODS TABLE SUMMARIZING CURRENT CONTROL LIMITS OF METHODS FOR OCP'S, PCB'S, HERBICIDES, SULFUR COMPOUNDS IN WATER 17:41:06 22 SEP 1990

| TH | TST NM | STORET | PARAMETER NAME | UNIT | CERTREPLIM | MAXIMUM CON | ACCURACY OCT | LOW SPIKE 3 DAY MOVING ACCURACY LIMITS MAA LCL | MAA LWL | MAA MEAN | MAA UWL | MAA UCL | PRECISION LIMITS MAP MEAN | MAP UWL | MAP UCL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02 | PCB016 | 34671 | PCB-1016 | UGL | .160000 | 6.4000 | 0.82600 Y | | | | | | | | |
| 02 | PCB260 | 39508 | PCB-1260 | UGL | .190000 | 6.3000 | 0.92500 Y | 78.04 | 83.96 | 95.81 | 107.66 | 113.58 | 17.37 | 35.60 | 44.72 |
| 13 | ABHC | 39337 | BHC,A | UGL | .038500 | .6380 | 0.94100 N | | | | | | | | |
| 13 | AENSLF | 34361 | ENDOSULFAN,A | UGL | .023000 | .5750 | 1.02000 N | 72.90 | 79.90 | 93.89 | 107.88 | 114.88 | 20.51 | 42.05 | 52.82 |
| 13 | ALDRN | 39330 | ALDRIN | UGL | .091800 | .6060 | 0.75600 Y | 61.56 | 70.91 | 89.60 | 108.29 | 117.64 | 27.41 | 56.19 | 70.58 |
| 13 | BBHC | 39338 | BHC,B | UGL | .024000 | .6000 | 0.89100 N | | | | | | | | |
| 13 | BENSLF | 34356 | ENDOSULFAN,B | UGL | .023000 | .5750 | 1.16000 N | 62.69 | 73.95 | 96.49 | 119.03 | 130.30 | 33.04 | 67.74 | 85.09 |
| 13 | CLDAN | 39350 | CHLORDANE | UGL | .265000 | 5.3000 | 0.96200 N | | | | | | | | |
| 13 | DBHC | 34259 | BHC,D | UGL | .029300 | .5940 | 1.15000 N | | | | | | | | |
| 13 | DLDRN | 39380 | DIELDRIN | UGL | .024000 | .6000 | 1.04000 Y | 79.08 | 86.86 | 102.44 | 118.01 | 125.80 | 22.83 | 46.81 | 58.80 |
| 13 | ENDRN | 39390 | ENDRIN | UGL | .023800 | .5940 | 1.32000 Y | 75.18 | 82.91 | 98.37 | 113.82 | 121.55 | 22.66 | 46.46 | 58.36 |
| 13 | ENDRNA | 34366 | ENDRIN ALDEHYDE | UGL | .028500 | .7130 | 1.00000 N | | | | | | | | |
| 13 | ESFSO4 | 34[illegible] | ENDOSULFAN SULFATE | UGL | .078600 | .6750 | 0.96100 N | | | | | | | | |
| 13 | HPCL | 39410 | HEPTACHLOR | UGL | .042300 | .6190 | 0.84900 N | 69.48 | 73.83 | 82.53 | 91.23 | 95.58 | 12.75 | 26.14 | 32.84 |
| 13 | HPCLE | 39420 | HEPTACHLOR EPOXIDE | UGL | .024500 | .6130 | 1.01000 N | | | | | | | | |
| 13 | ISODR | 39430 | ISODRIN | UGL | .056200 | 1.1000 | 0.91000 N | 76.38 | 79.50 | 85.75 | 91.99 | 95.11 | 9.15 | 18.75 | 23.56 |
| 13 | LIN | 39340 | BHC,G(LINDANE) | UGL | .050700 | .6190 | 0.96400 Y | 79.79 | 86.65 | 100.39 | 114.12 | 120.98 | 20.13 | 41.27 | 51.84 |
| 13 | MEXCLR | | | UGL | .057000 | 1.1600 | 1.26000 Y | 60.94 | 74.52 | 101.68 | 128.84 | 142.42 | 39.82 | 81.64 | 102.54 |
| 13 | PCB016 | | | UGL | .486000 | 8.2500 | 1.02000 Y | | | | | | | | |
| 13 | PCB260 | | | UGL | .636000 | 5.8800 | 1.06000 Y | | | | | | | | |
| 13 | PPDDD | 39310 | DDD,PP' | UGL | .023300 | .5810 | 1.17000 N | | | | | | | | |
| 13 | PPDDE | 39320 | DDE,PP' | UGL | .027000 | .6750 | 0.99900 N | | | | | | | | |
| 13 | PPDDT | 39300 | DDT,PP' | UGL | .034000 | .6630 | 0.94900 Y | 63.81 | 74.25 | 95.13 | 116.01 | 126.45 | 30.61 | 62.76 | 78.83 |
| 13 | TXPHEN | 39400 | TOXAPHENE | UGL | 1.350000 | 11.6000 | 1.00000 N | | | | | | | | |
| 14 | 245TP | 39760 | 2,4,5-TP/SILVEX | UGL | .181000 | 1.3600 | 0.93100 Y | | | | | | | | |
| 14 | 24D | 39730 | 2,4-D, TOTAL | UGL | .082000 | 2.5200 | 0.64600 Y | | | | | | | | |
| 04 | BTZ | 81512 | BENZOTHIAZOLE | UGL | 2.110000 | 42.2000 | 0.92700 N | | | | | | | | |
| 04 | CPMS | 98562 | P-CLPHENYLMETHYLSUL-FIDE | UGL | 1.260000 | 25.3000 | 0.82400 N | 60.96 | 69.29 | 85.95 | 102.61 | 110.95 | 24.43 | 50.08 | 62.91 |
| 04 | CPMSO | 98561 | P-CLPHENYLMETHYLSUL-FOXID | UGL | 4.230000 | 106.0000 | 0.74300 Y | 82.07 | 86.55 | 95.51 | 104.47 | 108.95 | 13.13 | 26.93 | 33.83 |
| 04 | CPMSO2 | 98560 | P-CLPHENYLMETHYLSUL-FONE | UGL | 4.720000 | 106.0000 | 0.86600 Y | | | | | | | | |
| 04 | DITH | 98563 | 1,4-DITHIANE | UGL | 1.110000 | 22.2000 | 0.83100 Y | 75.58 | 81.82 | 94.31 | 106.80 | 113.04 | 18.30 | 37.53 | 47.14 |
| 04 | DMDS | 81580 | DIMETHYLDISULFIDE | UGL | 1.140000 | 22.8000 | 0.80100 Y | 73.33 | 77.02 | 84.38 | 91.75 | 95.43 | 10.80 | 22.14 | 27.81 |
| 04 | OXAT | 98564 | 1,4-OXATHIANE | UGL | 1.980000 | 39.5000 | 0.82900 Y | 76.07 | 80.81 | 90.29 | 99.77 | 104.51 | 13.90 | 28.49 | 35.79 |
| 07 | ATZ | | | UGL | .512000 | 5.0000 | 1.04000 Y | 92.30 | 95.66 | 102.38 | 109.10 | 112.45 | 9.85 | 20.19 | 25.36 |
| 07 | DDVP | | | UGL | .250000 | 5.0000 | 0.88400 Y | 91.19 | 92.98 | 96.56 | 100.14 | 101.93 | 5.25 | 10.76 | 13.51 |
| 07 | MLTHN | | | UGL | .250000 | 5.0000 | 0.99900 Y | 98.09 | 100.58 | 105.56 | 110.54 | 113.03 | 7.30 | 14.96 | 18.79 |
| 07 | PRTHN | 39540 | PARATHION | UGL | .250000 | 5.0000 | 0.98300 Y | 75.43 | 84.44 | 102.46 | 120.48 | 129.49 | 26.42 | 54.16 | 68.04 |
| 07 | SUPONA | | | UGL | .250000 | 4.7000 | 1.00000 Y | 98.11 | 101.35 | 107.83 | 114.31 | 117.55 | 9.50 | 19.47 | 24.46 |

| TH | TST NM | STORET | UNIT | REPLICATE HIGH SPIKE ACCURACY LIMITS ACC LCL | ACC LWL | ACC MEAN | ACC UWL | ACC UCL | PRECISION LIMTS PREC MEAN | PREC UWL | PREC UCL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 04 | CPMS | 98562 | UGL | 68.99 | 71.31 | 75.95 | 80.58 | 82.90 | 3.70 | 9.29 | 12.08 |
| 04 | CPMSO | 98561 | UGL | 97.99 | 100.50 | 105.53 | 110.56 | 113.08 | 4.01 | 10.07 | 13.10 |
| 04 | DITH | 98563 | UGL | 84.96 | 86.53 | 89.68 | 92.83 | 94.40 | 2.51 | 6.30 | 8.20 |
| 04 | DMDS | 81580 | UGL | 75.16 | 76.87 | 80.30 | 83.73 | 85.44 | 2.73 | 6.87 | 8.93 |
| 04 | OXAT | 98564 | UGL | 85.03 | 86.46 | 89.30 | 92.15 | 93.58 | 2.27 | 5.70 | 7.42 |
| 07 | ATZ | | UGL | 89.60 | 94.71 | 104.92 | 115.13 | 120.24 | 8.15 | 20.46 | 26.62 |
| 07 | DDVP | | UGL | 54.91 | 66.10 | 88.47 | 110.84 | 122.03 | 17.85 | 44.82 | 58.31 |
| 07 | MLTHN | | [illegible]L | 90.19 | 93.17 | 99.12 | 105.07 | 108.05 | 4.75 | 11.9[illegible] | 15.51 |
| 07 | PRTHN | 39[illegible] | [illegible] | 90.01 | 93.36 | 100.07 | 106.78 | 110.14 | 5.35 | 13.[illegible] | 17.48 |
| [illegible] | SUPONA | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

METHODS TABLE SUMMARIZING CURRENT CONTROL LIMITS OF METHODS FOR OCP'S, PCB'S, HERBICIDES, SULFUR COMPOUNDS IN SOIL 17:41:06 22 SEP 1990

| M | TST NM | STORET | PARAMETER NAME | UNIT | CERTREPLIM | MAXIMUM CON | ACCURACY | OCT | LOW SPIKE 3 DAY MOVING ACCURACY LIMITS: MAA LCL | MAA LWL | MAA MEAN | MAA UWL | MAA UCL | PRECISION LIMITS: MAP MEAN | MAP UWL | MAP UCL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | ABHC | 98357 | BHC,A | UGG | .009070 | .0270 | 0.91900 | N | | | | | | | | |
| 8 | AENSLF | 98366 | ENDOSULFAN,A | UGG | .006020 | .0244 | 1.03000 | N | 70.04 | 76.84 | 90.45 | 104.05 | 110.85 | 19.94 | 40.88 | 51.35 |
| 8 | ALDRN | 98356 | ALDRIN,SED | UGG | .007290 | .0257 | 0.98800 | Y | 64.64 | 73.26 | 90.51 | 107.76 | 116.38 | 25.29 | 51.84 | 65.12 |
| 8 | BBHC | 98358 | BHC,B,SED | UGG | .002570 | .0254 | 0.97500 | N | | | | | | | | |
| 8 | BENSLF | 98367 | ENDOSULFAN,B | UGG | .006630 | .0244 | 1.10000 | N | 68.43 | 76.08 | 91.40 | 106.71 | 114.37 | 22.45 | 46.03 | 57.82 |
| 8 | CLDAN | 98361 | CHLORDANE,SED | UGG | .017700 | .1970 | 0.83900 | Y | | | | | | | | |
| 8 | DBHC | 98359 | BHC,D,SED | UGG | .005550 | .0252 | 1.28000 | N | | | | | | | | |
| 8 | DLDRN | 98365 | DIELDRIN | UGG | .006290 | .0254 | 1.04000 | Y | 74.77 | 82.16 | 96.94 | 111.72 | 119.11 | 21.67 | 44.43 | 55.81 |
| 8 | ENDRN | 98369 | ENDRIN | UGG | .006570 | .0252 | 1.09000 | Y | 69.92 | 79.24 | 97.90 | 116.55 | 125.87 | 27.35 | 56.06 | 70.42 |
| 8 | ENDRNA | 98370 | ENDRIN ALDEHYDE | UGG | .024000 | .0302 | 0.87100 | N | | | | | | | | |
| 8 | ESFSO4 | 98368 | ENDOSULFAN SULFATE | UGG | .007630 | .0286 | 1.06000 | N | | | | | | | | |
| 8 | HPCL | 98371 | HEPTACHLOR | UGG | .006180 | .0262 | 1.04000 | N | 72.40 | 81.01 | 98.23 | 115.44 | 124.05 | 25.24 | 51.75 | 65.00 |
| 8 | HPCLE | 98372 | HEPTACHLOR EPOXIDE | UGG | .006200 | .0260 | 1.04000 | N | | | | | | | | |
| 8 | ISODR | 98649 | ISODRIN | UGG | .004610 | .0412 | 0.94100 | Y | 74.95 | 81.32 | 94.07 | 106.81 | 113.19 | 18.69 | 38.31 | 48.12 |
| 8 | LIN | 98360 | BHC,G | UGG | .006380 | .0262 | 1.03000 | Y | 87.68 | 94.50 | 108.14 | 121.78 | 128.60 | 20.00 | 41.00 | 51.50 |
| 8 | MEXCLR | 97818 | METHOXYCHLOR | UGG | .071100 | .2490 | 1.20000 | Y | 76.59 | 86.74 | 107.06 | 127.38 | 137.54 | 29.79 | 61.06 | 76.70 |
| 8 | PPDDD | 98362 | DDD,PP' | UGG | .008260 | .0246 | 1.11000 | N | | | | | | | | |
| 8 | PPDDE | 98363 | DDE,PP' | UGG | .007650 | .0286 | 1.06000 | N | | | | | | | | |
| 8 | PPDDT | 98364 | DDT,PP' | UGG | .007070 | .0281 | 1.01000 | Y | | | | | | | | |
| 8 | TXPHEN | 98373 | TOXAPHENE | UGG | .444000 | 1.1200 | 1.35000 | N | | | | | | | | |
| 1 | 245TP | 97438 | | UGG | .008500 | .1090 | 0.90700 | Y | 45.23 | 55.95 | 77.37 | 98.80 | 109.51 | 31.41 | 64.40 | 80.89 |
| 1 | 24D | 99237 | | UGG | .017700 | .2020 | 1.08000 | Y | 40.12 | 53.85 | 81.31 | 108.78 | 122.51 | 40.27 | 82.55 | 103.69 |
| 6 | PCB016 | 98140 | PCB 1016 | UGG | .066600 | .3670 | 1.18000 | Y | 77.77 | 86.57 | 104.19 | 121.81 | 130.61 | 25.83 | 52.95 | 66.51 |
| 6 | PCB260 | 98139 | PCB 1260 | UGG | .080400 | .4070 | 1.06000 | Y | 73.84 | 83.07 | 101.54 | 120.01 | 129.25 | 27.08 | 55.51 | 69.73 |
| 3 | BTZ | 97302 | BENZOTHIAZOLE | UGG | 1.080000 | 13.2000 | 0.78800 | N | 84.05 | 88.83 | 98.37 | 107.92 | 112.70 | 14.00 | 28.70 | 36.05 |
| 3 | CPMS | 98653 | P-CLPHENYLMETHY- SULFIDE | UGG | 1.080000 | 21.6000 | 0.99900 | N | 78.22 | 83.43 | 93.86 | 104.28 | 109.49 | 15.28 | 31.32 | 39.34 |
| 3 | CPMSO | 98654 | P-CLPHENYLMETHY- SULFOXIDE | UGG | 2.250000 | 45.0000 | 1.02000 | Y | 69.01 | 77.64 | 94.91 | 112.18 | 120.81 | 25.32 | 51.90 | 65.19 |
| 3 | CPMSO2 | 98703 | P-CLPHENYLMETHY- SULFONE | UGG | 2.370000 | 47.4000 | 0.79000 | Y | 50.88 | 61.62 | 83.10 | 104.58 | 115.33 | 31.50 | 64.57 | 81.11 |
| 3 | DITH | 98650 | 1,4 DITHIANE | UGG | 1.470000 | 11.4000 | 0.91600 | Y | 85.67 | 90.29 | 99.54 | 108.79 | 113.41 | 13.56 | 27.79 | 34.91 |
| 3 | DMDS | 98697 | DMDS | UGG | .692000 | 13.8000 | 0.94600 | Y | 60.29 | 68.68 | 85.48 | 102.27 | 110.66 | 24.62 | 50.47 | 63.39 |
| 3 | OXAT | 98644 | 1,4 OXATHIANE | UGG | .856000 | 17.1000 | 0.93000 | Y | 82.70 | 87.13 | 95.99 | 104.86 | 109.29 | 13.00 | 26.65 | 33.47 |
| 5 | ATZ | 98655 | ATRAZINE | UGG | .250000 | 2.0000 | 1.12000 | Y | 97.68 | 100.41 | 105.86 | 111.32 | 114.05 | 8.00 | 16.40 | 20.60 |
| 5 | DDVP | 98646 | VAPONA | UGG | .452000 | 5.0000 | 1.02000 | Y | 74.06 | 86.80 | 112.28 | 137.75 | 150.49 | 37.36 | 76.58 | 96.20 |
| 5 | MLTHN | 98648 | MALATHION | UGG | .580000 | 5.0000 | 1.17000 | Y | 86.19 | 90.81 | 100.06 | 109.31 | 113.93 | 13.56 | 27.79 | 34.91 |
| 5 | PRTHN | 98658 | PARATHION | UGG | .733000 | 5.0000 | 1.23000 | Y | 87.09 | 91.87 | 101.42 | 110.96 | 115.74 | 14.00 | 28.70 | 36.05 |
| 5 | SUPONA | 98656 | SUPONA | UGG | .250000 | 5.0000 | 1.28000 | Y | 89.17 | 98.07 | 115.89 | 133.70 | 142.61 | 26.12 | 53.54 | 67.25 |

| M | TST NM | STORET | UNIT | REPLICATE HIGH SPIKE ACCURACY LIMITS: ACC LCL | ACC LWL | ACC MEAN | ACC UWL | ACC UCL | PRECISION LIMTS: PREC MEAN | PREC UWL | PREC UCL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | BTZ | 97302 | UGG | 78.83 | 81.35 | 86.39 | 91.42 | 93.94 | 4.02 | 10.09 | 13.13 |
| 3 | CPMS | 98653 | UGG | 89.68 | 91.39 | 94.81 | 98.22 | 99.93 | 2.72 | 6.84 | 8.90 |
| 3 | CPMSO | 98654 | UGG | 81.59 | 85.03 | 91.90 | 98.76 | 102.20 | 5.48 | 13.76 | 17.90 |
| 3 | CPMSO2 | 98703 | UGG | 77.62 | 80.15 | 85.22 | 90.28 | 92.81 | 4.04 | 10.14 | 13.19 |
| 3 | DITH | 98650 | UGG | 82.67 | 84.62 | 88.54 | 92.45 | 94.40 | 3.12 | 7.83 | 10.19 |
| 3 | DMDS | 98697 | UGG | 82.81 | 84.89 | 89.06 | 93.22 | 95.30 | 3.32 | 8.33 | 10.84 |
| 3 | OXAT | 98644 | UGG | 83.97 | 86.22 | 90.71 | 95.19 | 97.44 | 3.58 | 8.99 | 11.69 |
| 5 | ATZ | 98655 | UGG | 97.64 | 101.52 | 109.30 | 117.07 | 120.95 | 6.20 | 15.57 | 20.25 |
| 5 | DDVP | 98646 | UGG | 97.11 | 100.08 | 106.03 | 111.97 | 114.94 | 4.74 | 11.90 | 15.48 |
| 5 | MLTHN | 98648 | UGG | 98.66 | 102.38 | 109.83 | 117.27 | 120.99 | 5.94 | 14.91 | 19.40 |
| 5 | PRTHN | 98658 | UGG | 106.90 | 110.02 | 116.26 | 122.49 | 125.61 | 4.97 | 12.49 | 16.25 |
| 5 | SUPONA | 98656 | UGG | 103.12 | 107.70 | 116.85 | 125.99 | 130.57 | 7.30 | 18.33 | 23.84 |

# A.4

# Inorganic Method Comparison

USATHAMA & EPA
INORGANIC METHOD COMPARISON

1. Sample Preparation
   a. GFAA water - same as CLP.
   b. ICP water - same as CLP.
   c. GFAA soil - same as CLP with one exception, the digestate's final volume is 100 mLs. CLP digestates have a final volume of 200 mLs.
   d. ICP soil - same as CLP with one exception, the digestate's final volume is 100 mLs. CLP digestates have a final volume of 200 mLs.
   e. Mercury water - same as CLP.
   f. Mercury soil - same as CLP with one exception, CLP uses 0.2 g while USATHAMA requires 1 g.
   g. Cyanide - same as CLP with one exception, CLP requires 1-5 g while USATHAMA requires 10 g.
   h. Other inorganic methods certified or used by USATHAMA such as phenols, COD, TOC, TOX, TP, CrIV, etc. follow expected EPA methods.

2. Detection Limits

   Tables in Appendix A.2 present comparisons of reporting limits.

3. Analysis Comparison

   CLP requires matrix spike and matrix duplicates and quarterly detection limit studies to evaluate method performance. USATHAMA requires method certification and daily control spikes to evaluate method performance and validity of certification. Daily control spikes and QC charting include a single low level (2 times the CRL) control spike and replicate high level (80% of upper certified range). Therefore, matrix spikes are not required except when requested as additional samples to evaluate applicability of the matrix to the certified method.

# A.5

## Organic Method Comparison

USATHAMA & EPA

ORGANIC METHOD COMPARISON

1. Sample Preparation

   a. BNA in water - in the extraction by USATHAMA certified method UM18, the base fraction is combined with the acid fraction extract before passing through the drying column and both fractions are concentrated in the same K-d. This should improve the detection limit sensitivity.

   b. BNA in soil - The EPA-CLP method utilizes the sonication technique for soil extraction. USATHAMA certified method LM18 prepares BNA's using the continuous sohxlet extraction technique. The techniques are basically equivalent. The continuous (16 to 24 hr) sohxlet extraction is possibly more efficient than a 1-2 minute sonication.

   c. VOA's in water and soil - USATHAMA certified methods UM20 and LM19 follow equivalent sample preparation procedures as EPA-CLP methods. Method LM19 is the low level heated purge and trap method using up to 5 grams of soil.

2. Detection Limits

   Tables in Appendix A.2 compare USATHAMA CRL's and EPA CLP reporting limits.

3. Analysis Comparison

   a. EPA-CLP requires instrument tuning with DFTPP or BFB every 12 hours (no end run standard is required, therefore if an analytical run is less than 12 hours no calibration confirmation is required). USATHAMA requires tuning with DFTPP or BFB every 12 hours and an end of run calibration standard is, therefore, not required. Analytical runs cannot be longer than 24 hours.

   b. EPA-CLP controls on Continuing Calibration Check (C.C.C.) compounds run at the beginning of a batch and the 12 hour standards (if the run is longer than 12 hours). Current criteria is $\pm$ 25% difference from initial calibration compared to the average response factors (RF). USATHAMA also controls on the beginning C.C.C. with a $\pm$ 25% difference from initial calibration but compares to the RF from the midpoint. Both EPA-CLP and USATHAMA require initial calibrations at five concentration levels with $\pm$ 30% RSD.

# A.6

## Summary of Spike Protocols

Table 1. Summary of 'Control Limits' for Sample Matrix Spikes and Sample Surrogate Spikes to be performed at JAAP.
(page 1 of 2)

Metals Methods: Sample Matrix Spike criteria will closely follow CLP SOW390 for Inorganics

ICP Methods: Sample Matrix spikes at a frequency of 5% of the environmental water and soil samples will be spiked for the control analytes and recoveries should be within 100 +/- 25%. Control Analytes are:

Soils (Method JS11): Ba, Be, Cd, Cr, Cu, Ni, Tl, and Zn

Waters (Method SS10): Ba, Be, Ca, Cd, Co, Cr, Cu, Mg, Nn, Na, Ni, Zn

GFAA Methods: Sample Matrix spikes at a frequency of 5% of the environmental water and soil samples will be spiked and recoveries should be within 100 +/- 25%.

Post Digestion spikes at a frequency of 5% of the environmental water and soil digestates will be spiked and recoveries should be within 100 +/- 15% as long as the background concentration is low enough.

Soils (Methods JD15, 18, 19): Se, Ag, As

Water (Methods SD09, 20, 21, 22, 23, 28): Tl, Pb, Se, As, Ag, Sb

Hg Methods: Sample Matrix spikes at a frequency of 5% of the environmental water and soil samples will be spiked and recoveries should be within 100 +/- 25%.

Inorganics/TRPH (Nitrate, Sulfate, Total Phosphate):

Sample Matrix spikes at a frequency of 5% of the environmental water and soil samples will be spiked and recoveries should be within 100 +/- 25% for TRPH and 100 +/- 15% for nitrate.

Table 1. Summary of 'Control Limits' for Sample Matrix Spikes and Sample Surrogate Spikes to be performed at JAAP.
(page 2 of 2)

GCMS Methods: Surrogates will be spiked for every sample and criteria for sample surrogates will closely follow CLP SOW--- for Organics.

VOA Methods (UM20, LM19):

| Surrogate | Water Limits | Soil Limits |
|---|---|---|
| 12DCD4 | 76-114 | 70-121 |
| 4BFB | 86-115 | 74-121 |
| MEC6D8 | 88-110 | 81-117 |

BNA Methods (UM18, LM18):

| Surrogate | Water Limits | Soil Limits |
|---|---|---|
| 2FP | 21-100 | 25-121 |
| PHEND6 | 10-94 | 24-113 |
| 246TBP | 10-123 | 19-122 |
| NBD5 | 35-114 | 23-120 |
| 2FBP | 43-116 | 30-115 |
| TRPD14 | 33-141 | 18-137 |

Pesticide/PCB Methods:

The surrogate decachlorobiphenyl (DCBP) will be spiked on the samples analyzed for Pesticides and PCB's. The EPA CLP advisory limits of 60 to 150% will be used as guidelines for flagging data for matrix effects.

Explosives Methods:

Sample Matrix spikes at a frequency of 5% of the environmental water and soil samples will be spiked with the control analytes and recoveries should be within +/- 25% of the mean recovery for daily control spikes. Current mean recoveries for control analytes are:

| Compound | Water Mean % | Soil Mean % |
|---|---|---|
| 24DNT | 82 | 87 |
| NB | 86 | 94 |
| RDX | 85 | 94 |
| 135TNB | 85 | 96 |
| 246TNT | 85 | 97 |

Table 2. Summary of Matrix Spike and Surrogate Spike Protocols (page 1 of 3)

| | WATERS | | | | | SOILS | | | |
|---|---|---|---|---|---|---|---|---|---|
| USATHAMA Method | Spike Solution Conc. ug/mL | Volume Spike Solution Used mL | Sample Volume mL | Matrix Spike Conc. ug/L | USATHAMA Method | Spike Solution Conc. ug/mL | Volume Spike Solution Used mL | Sample Weight g | Matrix Spike Conc. ug/g |
| **ICP Metals Matrix Spikes** | | | | | | | | | |
| SS10 | | | | | JS11 | | | | |
| Al | 20.0 | 5.0 | 50.0 | 2000 | Be | 3.0 | 5.0 | 1.0 | 15 |
| Ba | 20.0 | | | 2000 | Cd | 3.0 | | | 15 |
| Be | 0.5 | | | 50 | | | | | |
| Cd | 0.5 | | | 50 | Cr | 50.0 | 40.0 | 1.0 | 2000 |
| Cr | 2.0 | | | 200 | Cu | 50.0 | | | 2000 |
| Co | 5.0 | | | 500 | Ni | 50.0 | | | 2000 |
| Cu | 2.5 | | | 250 | Tl | 50.0 | | | 2000 |
| Fe | 10.0 | | | 1000 | Zn | 50.0 | | | 2000 |
| Pb | 5.0 | | | 500 | | | | | |
| Mn | 5.0 | | | 500 | | | | | |
| Ni | 5.0 | | | 500 | | | | | |
| V | 5.0 | | | 500 | | | | | |
| Zn | 5.0 | | | 500 | | | | | |
| Ca | 100.0 | | | 10000 | | | | | |
| Mg | 100.0 | | | 10000 | | | | | |
| Na | 100.0 | | | 10000 | | | | | |
| K | 100.0 | | | 10000 | | | | | |
| **GFAA Metals Matrix Spikes** | | | | | | | | | |
| SD09 Tl | 2.0 | 0.50 | 100 | 10.0 | JD15 Se | 7.50 | 0.50 | 1.0 | 3.75 |
| SD20 Pb | 8.0 | | | 40.0 | JD19 As | 8.00 | | | 4.0 |
| SD21 Se | 7.50 | | | 37.5 | | | | | |
| SD22 As | 7.50 | | | 37.5 | JD18 Ag | 0.20 | 2.0 | 1.0 | 0.40 |
| SD23 Ag | 0.80 | | | 4.0 | | | | | |
| SD28 Sb | 1.0 | 8.0 | 100 | 80.0 | | | | | |
| **CVAA Metals Matrix Spikes** | | | | | | | | | |
| SB01 Hg | 0.10 | 5.0 | 100 | 5.0 | JB01 Hg | 0.10 | 5.0 | 1.0 | 0.50 |

Table 2. Summary of Matrix Spike and Surrogate Spike Protocols (page 2 of 3)

| | WATERS | | | | | SOILS | | | |
|---|---|---|---|---|---|---|---|---|---|
| USATHAMA Method | Spike Solution Conc. ug/mL | Volume Spike Solution Used mL | Sample Volume mL | Matrix Spike Conc. ug/L | USATHAMA Method | Spike Solution Conc. ug/mL | Volume Spike Solution Used mL | Sample Weight g | Matrix Spike Conc. ug/g |
| **Inorganics Matrix Spikes** | | | | | | | | | |
| TRPH | 8500 | 0.50 | 1000 | 4250 | TRPH | 8500 | 2.0 | 15 | 1133 |
| TF22 NO3- | 0.15 | 1.0 | 1.0 | 75 | KF10 NO3- | 100 | 0.20 | 2.0 | 10 |
| TT10 SO4 | 250 | 1.0 | 1.0 | 125000 | KT05 SO4 | 400 | 2.0 | 2.0 | 400 |
| TF27 TP | 10 | 1.0 | 25.0 | 400 | KF14 TP | 1000 | 0.10 | 0.15 | 667 |
| **Explosives Matrix Spikes** | | | | | | | | | |
| UW32 | | | | | LW12 | | | | |
| RDX | 12.5 | 1 | 500 | 25 | RDX | 24 | 0.4 | 1 | 10 |
| 135TNB | 10 | | | 20 | 135TNB | 22 | | | 9 |
| NB | 10 | | | 20 | NB | 60 | | | 24 |
| TNT | 10 | | | 20 | TNT | 20 | | | 8 |
| 24DNT | 2.5 | | | 5 | 24DNT | 24 | | | 10 |
| 2NT | 5 | | | 10 | 2NT | 260 | 0.1 | 1 | 26 |

Table 2. Summary of Matrix Spike and Surrogate Spike Protocols (page 3 of 3)

| WATERS | | | | | SOILS | | | | |
|---|---|---|---|---|---|---|---|---|---|
| USATHAMA Method | Spike Solution Conc. ug/mL | Volume Spike Solution Used mL | Sample Volume mL | Matrix Spike Conc. ug/L | USATHAMA Method | Spike Solution Conc. ug/mL | Volume Spike Solution Used mL | Sample Weight g | Matrix Spike Conc. ug/g |
| GCMS Surrogates | | | | | | | | | |
| UM20 VOAs | 10 | 0.025 | 5 | 50 | LM19 VOAs | 10 | 0.025 | 5 | 0.05 |
| Surrogates = 4BFB 12DCD4 MEC6D8 | | | | | | | | | |
| UM18 SVOAs | | | | | LM18 SVOAs | | | | |
| B/N | 100 | 0.5 | 1000 | 50 | B/N | 50 | 1 | 15 | 3.33 |
| Acids | 200 | 0.5 | | 100 | Acids | 100 | | | 6.67 |
| Surrogates in separate mixed solutions: | | | | | | | | | |
| Acids = 2FP PHEND6 246TBP | | | | | | | | | |
| Base/Nuetrals = NBD5 2FBP TRPD14 | | | | | | | | | |
| Pesticides/PCBs Surrogates | | | | | | | | | |
| UH13/UH02 | | | | | LH10/LH16 | | | | |
| DCBP | 1 | 1 | 800 | 1.25 | DCBP | 1 | 1 | 15 | 0.067 |
| TCMX | 1 | | | 1.25 | TCMX | 1 | | | 0.067 |

## A.7

## Current USATHAMA Methods Table

2/5/92

ENTER LAB FOR THIS PRINTOUT: ES
1018 records copied
1018 indexed 1018 Records indexed

| Record# | M_LAB | M_METH_NO | METH_NAME | M_TST_NAM | CERTREPLIM | MAXCON | M_ACCURAC | HOLD_TIME | HOLD_TIME1 | HOLD_TIME2 |
|---|---|---|---|---|---|---|---|---|---|---|
| 446 | ES | 00 | | | 0.000000 | 0.0000 | .000 | 0 | 0 | 0 |
| 447 | ES | 99 | | | 0.000000 | 0.0000 | .000 | 0 | 0 | 0 |
| | ES | A6 | PESTICIDES/TISSUE/GCEC | 44DCBZ | 0.012000 | 0.2330 | .773 | 999 | 7 | 40 |
| | ES | A6 | PESTICIDES/TISSUE/GCEC | ALDRN | 0.026000 | 0.2330 | .662 | 999 | 7 | 40 |
| 3 | ES | A6 | PESTICIDES/TISSUE/GCEC | DLDRN | 0.043000 | 0.2070 | .716 | 999 | 7 | 40 |
| 4 | ES | A6 | PESTICIDES/TISSUE/GCEC | ENDRN | 0.039000 | 0.2000 | .756 | 999 | 7 | 40 |
| 5 | ES | A7 | METALS/AIR/COLDVAPORAA | HG | 0.062900 | 0.6940 | .751 | 180 | 0 | 0 |
| 6 | ES | A8 | METALS/WATER/AA | AS | 3.880000 | 50.0000 | .976 | 180 | 0 | 0 |
| 7 | ES | ABA | METALS/WATER/GFAA | AS | 3.070000 | 50.0000 | 1.00 | 180 | 0 | 0 |
| 939 | ES | AA01 | VOLATILES/AIR/GCMS | CCL4 | 0.120000 | 1.0000 | .746 | 14 | 0 | 0 |
| 941 | ES | AA01 | VOLATILES/AIR/GCMS | CH2CL2 | 1.000000 | 90.0000 | .578 | 14 | 0 | 0 |
| 940 | ES | AA01 | VOLATILES/AIR/GCMS | CHCL3 | 13.000000 | 320.0000 | .746 | 14 | 0 | 0 |
| 8 | ES | AA8 | METALS/WATER/AA | K | 1256.000000 | 50000.0000 | 1.01 | 180 | 0 | 0 |
| 9 | ES | AAA9 | AGENTPRODS/SOIL/IONCHROM | FC2A | 2.000000 | 40.0000 | .929 | 0 | 7 | 40 |
| 10 | ES | AAA9 | AGENTPRODS/SOIL/IONCHROM | IMPA | 2.110000 | 40.0000 | .929 | 0 | 7 | 40 |
| 11 | ES | AAA9 | AGENTPRODS/SOIL/IONCHROM | MPA | 2.000000 | 40.0000 | .866 | 0 | 7 | 40 |
| 12 | ES | AD01 | METALS/AIR/GFAA | SE | 0.002130 | 0.0100 | .767 | 180 | 0 | 0 |
| 13 | ES | AD02 | METALS/AIR/GFAA | AS | 0.003060 | 0.0100 | .635 | 180 | 0 | 0 |
| 14 | ES | B7 | METALS/AIR/ICPLASMA-AA | AS | 0.003100 | 0.0100 | .635 | 180 | 0 | 0 |
| 15 | ES | B7 | METALS/AIR/ICPLASMA-AA | CD | 0.001980 | 0.1000 | .931 | 180 | 0 | 0 |
| 16 | ES | B7 | METALS/AIR/ICPLASMA-AA | CR | 0.002600 | 0.1000 | .869 | 180 | 0 | 0 |
| 17 | ES | B7 | METALS/AIR/ICPLASMA-AA | CU | 0.016400 | 0.2000 | .887 | 180 | 0 | 0 |
| 18 | ES | B7 | METALS/AIR/ICPLASMA-AA | PB | 0.007700 | 0.2000 | .915 | 180 | 0 | 0 |
| 19 | ES | B7 | METALS/AIR/ICPLASMA-AA | ZN | 0.009700 | 0.5000 | .865 | 180 | 0 | 0 |
| 20 | ES | B8 | METALS/WATER/ICP | CA | 500.000000 | 50000.0000 | .974 | 180 | 0 | 0 |
| 21 | ES | B8 | METALS/WATER/ICP | CD | 5.160000 | 5000.0000 | 1.00 | 180 | 0 | 0 |
| 22 | ES | B8 | METALS/WATER/ICP | CR | 5.960000 | 5000.0000 | 1.01 | 180 | 0 | 0 |
| 23 | ES | B8 | METALS/WATER/ICP | CU | 7.930000 | 10000.0000 | .985 | 180 | 0 | 0 |
| 24 | ES | B8 | METALS/WATER/ICP | MG | 500.000000 | 20000.0000 | .988 | 180 | 0 | 0 |
| 25 | ES | B8 | METALS/WATER/ICP | NA | 764.000000 | 50000.0000 | .954 | 180 | 0 | 0 |
| 26 | ES | B8 | METALS/WATER/ICP | PB | 18.600000 | 5000.0000 | .945 | 180 | 0 | 0 |
| 27 | ES | B8 | METALS/WATER/ICP | ZN | 20.100000 | 20000.0000 | .949 | 180 | 0 | 0 |
| 28 | ES | BB8 | ORGANICS/WATER/GCMS | 13DBD4 | 23.000000 | 94.0000 | .362 | 0 | 7 | 40 |
| 29 | ES | BB8 | ORGANICS/WATER/GCMS | 2CLPD4 | 7.400000 | 94.0000 | .803 | 0 | 7 | 40 |
| 30 | ES | BB8 | ORGANICS/WATER/GCMS | ALDRN | 4.700000 | 94.0000 | .904 | 0 | 7 | 40 |
| 31 | ES | BB8 | ORGANICS/WATER/GCMS | ATZ | 5.900000 | 94.0000 | 1.05 | 0 | 7 | 40 |
| | ES | BB8 | ORGANICS/WATER/GCMS | CL6CP | 11.000000 | 46.9000 | .468 | 0 | 7 | 40 |
| | ES | BB8 | ORGANICS/WATER/GCMS | CLDAN | 5.100000 | 94.0000 | 1.02 | 0 | 7 | 40 |
| 34 | ES | BB8 | ORGANICS/WATER/GCMS | CPMS | 14.000000 | 94.0000 | .662 | 0 | 7 | 40 |
| 35 | ES | BB8 | ORGANICS/WATER/GCMS | CPMSO | 17.000000 | 94.0000 | 1.18 | 0 | 7 | 40 |
| 36 | ES | BB8 | ORGANICS/WATER/GCMS | CPMSO2 | 8.000000 | 94.0000 | 1.05 | 0 | 7 | 40 |
| 37 | ES | BB8 | ORGANICS/WATER/GCMS | DBCP | 15.000000 | 94.0000 | .563 | 0 | 7 | 40 |
| 38 | ES | BB8 | ORGANICS/WATER/GCMS | DCPD | 4.700000 | 19.0000 | .572 | 0 | 7 | 40 |
| 39 | ES | BB8 | ORGANICS/WATER/GCMS | DDVP | 9.000000 | 47.0000 | .962 | 0 | 7 | 40 |
| 40 | ES | BB8 | ORGANICS/WATER/GCMS | DEPD4 | 5.800000 | 94.0000 | 1.05 | 0 | 7 | 40 |
| 41 | ES | BB8 | ORGANICS/WATER/GCMS | DIMP | 5.700000 | 94.0000 | .995 | 0 | 7 | 40 |
| 42 | ES | BB8 | ORGANICS/WATER/GCMS | DITH | 11.000000 | 94.0000 | .709 | 0 | 7 | 40 |
| 43 | ES | BB8 | ORGANICS/WATER/GCMS | DLDRN | 4.700000 | 94.0000 | 1.02 | 0 | 7 | 40 |
| 44 | ES | BB8 | ORGANICS/WATER/GCMS | DNOPD4 | 13.000000 | 94.0000 | 1.14 | 0 | 7 | 40 |
| 45 | ES | BB8 | ORGANICS/WATER/GCMS | ENDRN | 7.600000 | 47.0000 | 1.10 | 0 | 7 | 40 |
| 46 | ES | BB8 | ORGANICS/WATER/GCMS | ISODR | 5.900000 | 94.0000 | .918 | 0 | 7 | 40 |
| 47 | ES | BB8 | ORGANICS/WATER/GCMS | MLTHN | 7.600000 | 47.0000 | 1.05 | 0 | 7 | 40 |
| 48 | ES | BB8 | ORGANICS/WATER/GCMS | OXAT | 6.100000 | 94.0000 | .716 | 0 | 7 | 40 |
| 49 | ES | BB8 | ORGANICS/WATER/GCMS | PPDDE | 4.700000 | 94.0000 | .972 | 0 | 7 | 40 |
| 50 | ES | BB8 | ORGANICS/WATER/GCMS | PPDDT | 10.000000 | 47.0000 | 1.15 | 0 | 7 | 40 |
| 51 | ES | BB8 | ORGANICS/WATER/GCMS | PRTHN | 14.000000 | 94.0000 | 1.20 | 0 | 7 | 40 |
| 52 | ES | BB8 | ORGANICS/WATER/GCMS | SUPONA | 6.500000 | 94.0000 | 1.07 | 0 | 7 | 40 |
| 53 | ES | C7 | VOLATILES/AIR/GCMS | 111TCE | 22.000000 | 220.0000 | .739 | 14 | 0 | 0 |
| 54 | ES | C7 | VOLATILES/AIR/GCMS | 112TCE | 6.000000 | 220.0000 | .721 | 14 | 0 | 0 |
| 55 | ES | C7 | VOLATILES/AIR/GCMS | 11DCLE | 27.000000 | 220.0000 | .834 | 14 | 0 | 0 |
| 56 | ES | C7 | VOLATILES/AIR/GCMS | 12DCE | 27.000000 | 220.0000 | .867 | 14 | 0 | 0 |
| 57 | ES | C7 | VOLATILES/AIR/GCMS | 12DCLE | 26.000000 | 220.0000 | .735 | 14 | 0 | 0 |
| 58 | ES | C7 | VOLATILES/AIR/GCMS | 12DMB | 19.000000 | 88.0000 | .593 | 14 | 0 | 0 |
| 59 | ES | C7 | VOLATILES/AIR/GCMS | BCHPD | 19.000000 | 220.0000 | .692 | 14 | 0 | 0 |
| 60 | ES | C7 | VOLATILES/AIR/GCMS | C6H6 | 26.000000 | 220.0000 | .734 | 14 | 0 | 0 |
| 61 | ES | C7 | VOLATILES/AIR/GCMS | CCL4 | 12.000000 | 220.0000 | .746 | 14 | 0 | 0 |
| 62 | ES | C7 | VOLATILES/AIR/GCMS | CH2CL2 | 11.000000 | 90.0000 | .578 | 14 | 0 | 0 |
| 63 | ES | C7 | VOLATILES/AIR/GCMS | CHCL3 | 13.000000 | 220.0000 | .746 | 14 | 0 | 0 |
| 64 | ES | C7 | VOLATILES/AIR/GCMS | CLC6H5 | 29.000000 | 220.0000 | .673 | 14 | 0 | 0 |
| 65 | ES | C7 | VOLATILES/AIR/GCMS | DBCP | 40.000000 | 44.0000 | .413 | 14 | 0 | 0 |
| 66 | ES | C7 | VOLATILES/AIR/GCMS | DCPD | 19.000000 | 89.0000 | 1.27 | 14 | 0 | 0 |
| | ES | C7 | VOLATILES/AIR/GCMS | DMDS | 22.000000 | 220.0000 | .734 | 14 | 0 | 0 |
| | ES | C7 | VOLATILES/AIR/GCMS | ETC6H5 | 20.000000 | 220.0000 | .628 | 14 | 0 | 0 |
| 69 | ES | C7 | VOLATILES/AIR/GCMS | MEC6H5 | 7.000000 | 220.0000 | .716 | 14 | 0 | 0 |
| 70 | ES | C7 | VOLATILES/AIR/GCMS | MIBK | 8.000000 | 220.0000 | .804 | 14 | 0 | 0 |
| 71 | ES | C7 | VOLATILES/AIR/GCMS | TCLEE | 18.000000 | 220.0000 | .625 | 14 | 0 | 0 |
| 72 | ES | C7 | VOLATILES/AIR/GCMS | TRCLE | 19.000000 | 220.0000 | .625 | 14 | 0 | 0 |
| 73 | ES | C7 | VOLATILES/AIR/GCMS | XYLEN | 31.000000 | 170.0000 | .611 | 14 | 0 | 0 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 74 | ES | CM01 | VOLATILES/AIR/GCMS | 111TCE | 22.000000 | 220.0000 | .739 | 14 | 0 | 0 |
| 75 | ES | CM01 | VOLATILES/AIR/GCMS | 112TCE | 6.000000 | 220.0000 | .721 | 14 | 0 | 0 |
| 76 | ES | CM01 | VOLATILES/AIR/GCMS | 11DCLE | 27.000000 | 220.0000 | .834 | 14 | 0 | 0 |
| 77 | ES | CM01 | VOLATILES/AIR/GCMS | 12DCE | 27.000000 | 220.0000 | .867 | 14 | 0 | 0 |
| 78 | ES | CM01 | VOLATILES/AIR/GCMS | 12DCLE | 26.000000 | 220.0000 | .735 | 14 | 0 | 0 |
| 79 | ES | CM01 | VOLATILES/AIR/GCMS | 12DMB | 19.000000 | 88.0000 | .593 | 14 | 0 | 0 |
| 80 | ES | CM01 | VOLATILES/AIR/GCMS | BCHPD | 22.000000 | 220.0000 | .692 | 14 | 0 | 0 |
| 81 | ES | CM01 | VOLATILES/AIR/GCMS | C6H6 | 26.000000 | 220.0000 | .734 | 14 | 0 | [illegible] |
| 82 | ES | CM01 | VOLATILES/AIR/GCMS | CCL4 | 12.000000 | 220.0000 | .746 | 14 | 0 | |
| 83 | ES | CM01 | VOLATILES/AIR/GCMS | CH2CL2 | 11.000000 | 90.0000 | .578 | 14 | 0 | [illegible] |
| 84 | ES | CM01 | VOLATILES/AIR/GCMS | CHCL3 | 13.000000 | 220.0000 | .746 | 14 | 0 | 0 |
| 85 | ES | CM01 | VOLATILES/AIR/GCMS | CLC6H5 | 29.000000 | 220.0000 | .673 | 14 | 0 | 0 |
| 86 | ES | CM01 | VOLATILES/AIR/GCMS | DBCP | 40.000000 | 44.0000 | .413 | 14 | 0 | 0 |
| 87 | ES | CM01 | VOLATILES/AIR/GCMS | DCPD | 19.000000 | 89.0000 | 1.27 | 14 | 0 | 0 |
| 88 | ES | CM01 | VOLATILES/AIR/GCMS | DMDS | 19.000000 | 220.0000 | .734 | 14 | 0 | 0 |
| 89 | ES | CM01 | VOLATILES/AIR/GCMS | ETC6H5 | 20.000000 | 220.0000 | .628 | 14 | 0 | 0 |
| 90 | ES | CM01 | VOLATILES/AIR/GCMS | MEC6H5 | 7.000000 | 220.0000 | .716 | 14 | 0 | 0 |
| 91 | ES | CM01 | VOLATILES/AIR/GCMS | MIBK | 8.000000 | 220.0000 | .804 | 14 | 0 | 0 |
| 92 | ES | CM01 | VOLATILES/AIR/GCMS | TCLEE | 18.000000 | 220.0000 | .582 | 14 | 0 | 0 |
| 93 | ES | CM01 | VOLATILES/AIR/GCMS | TRCLE | 19.000000 | 220.0000 | .625 | 14 | 0 | 0 |
| 94 | ES | CM01 | VOLATILES/AIR/GCMS | XYLEN | 31.000000 | 170.0000 | .611 | 14 | 0 | 0 |
| 95 | ES | D7 | ORGANICS/AIR/GCMS | ATZ | 0.023000 | 0.7900 | .905 | 14 | 0 | 0 |
| 96 | ES | D7 | ORGANICS/AIR/GCMS | DLDRN | 0.018000 | 0.0990 | .881 | 14 | 0 | 0 |
| 97 | ES | D7 | ORGANICS/AIR/GCMS | ENDRN | 0.015000 | 0.0990 | .581 | 14 | 0 | 0 |
| 98 | ES | D7 | ORGANICS/AIR/GCMS | PPDDE | 0.011000 | 0.0990 | .691 | 14 | 0 | 0 |
| 99 | ES | D7 | ORGANICS/AIR/GCMS | PPDDT | 0.022000 | 0.0990 | .448 | 14 | 0 | 0 |
| 100 | ES | D7 | ORGANICS/AIR/GCMS | PRTHN | 0.046000 | 0.7900 | .956 | 14 | 0 | 0 |
| 964 | ES | G007 | EXPLOSIVES/SURFACE/NONE | XPLOSV | 0.360000 | 0.0000 | 0 | 0 | 0 | 0 |
| 450 | ES | H2 | PHENOLS/WATER/TECHNICON | PHENLC | 7.120000 | 50.0000 | .878 | 28 | 0 | 0 |
| 451 | ES | J2 | METALS/WATER/TECHNICON | CRHEX | 2.500000 | 50.0000 | .994 | 1 | 0 | 0 |
| 101 | ES | JB01 | METALS/SOIL/CVAA | HG | 0.050000 | 1.0000 | 1.02 | 28 | 0 | 0 |
| 102 | ES | JD02 | METALS/SOIL/GFAA | AS | 4.700000 | 50.0000 | .964 | 180 | 0 | 0 |
| 103 | ES | JD03 | METALS/SOIL/GFAA | SE | 8.300000 | 50.0000 | .742 | 180 | 0 | 0 |
| 799 | ES | JD15 | METALS/SOIL/GFAA | SE | 0.250000 | 10.0000 | .757 | 180 | 0 | 0 |
| 800 | ES | JD16 | METALS/SOIL/GFAA | V | 0.775000 | 20.0000 | .833 | 180 | 0 | 0 |
| 801 | ES | JD17 | METALS/SOIL/GFAA | PB | 0.177000 | 10.0000 | .890 | 180 | 0 | 0 |
| 802 | ES | JD18 | METALS/SOIL/GFAA | AG | 0.025000 | 1.0000 | .882 | 180 | 0 | 0 |
| 803 | ES | JD19 | METALS/SOIL/GFAA | AS | 0.250000 | 10.0000 | .842 | 180 | 0 | 0 |
| 963 | ES | JD24 | METALS/SOIL/FURNACE | TL | 0.319000 | 10.0000 | .864 | 180 | 0 | 0 |
| 962 | ES | JD25 | METALS/SOIL/FURNACE | SB | 1.090000 | 20.0000 | .849 | 180 | 0 | 0 |
| 104 | ES | JS01 | METALS/SOIL/ICP | AG | 6.020000 | 50.0000 | 1.04 | 180 | 0 | 0 |
| 453 | ES | JS01 | METALS/SOIL/ICP | BA | 0.863000 | 200.0000 | 1.01 | 180 | 0 | |
| 105 | ES | JS01 | METALS/SOIL/ICP | BE | 5.100000 | 50.0000 | .867 | 180 | 0 | |
| 106 | ES | JS01 | METALS/SOIL/ICP | CD | 3.490000 | 50.0000 | 1.09 | 180 | 0 | [illegible] |
| 107 | ES | JS01 | METALS/SOIL/ICP | CR | 7.720000 | 50.0000 | 1.07 | 180 | 0 | 0 |
| 108 | ES | JS01 | METALS/SOIL/ICP | CU | 6.560000 | 50.0000 | .929 | 180 | 0 | 0 |
| 109 | ES | JS01 | METALS/SOIL/ICP | NI | 5.410000 | 50.0000 | .927 | 180 | 0 | 0 |
| 110 | ES | JS01 | METALS/SOIL/ICP | PB | 6.810000 | 50.0000 | .952 | 180 | 0 | 0 |
| 452 | ES | JS01 | METALS/SOIL/ICP | SB | 4.640000 | 200.0000 | .954 | 180 | 0 | 0 |
| 111 | ES | JS01 | METALS/SOIL/ICP | TL | 12.300000 | 50.0000 | .860 | 180 | 0 | 0 |
| 112 | ES | JS01 | METALS/SOIL/ICP | ZN | 12.400000 | 50.0000 | .936 | 180 | 0 | 0 |
| 876 | ES | JS11 | METALS/SOIL/ICP | AG | 2.500000 | 50.0000 | .965 | 180 | 0 | 0 |
| 877 | ES | JS11 | METALS/SOIL/ICP | AL | 14.100000 | 50000.0000 | .891 | 180 | 0 | 0 |
| 878 | ES | JS11 | METALS/SOIL/ICP | B | 32.700000 | 200.0000 | .602 | 180 | 0 | 0 |
| 879 | ES | JS11 | METALS/SOIL/ICP | BA | 29.600000 | 200.0000 | .629 | 180 | 0 | 0 |
| 880 | ES | JS11 | METALS/SOIL/ICP | BE | 1.860000 | 20.0000 | .739 | 180 | 0 | 0 |
| 881 | ES | JS11 | METALS/SOIL/ICP | BI | 31.500000 | 5000.0000 | .725 | 180 | 0 | 0 |
| 882 | ES | JS11 | METALS/SOIL/ICP | CA | 59.000000 | 50000.0000 | .947 | 180 | 0 | 0 |
| 883 | ES | JS11 | METALS/SOIL/ICP | CD | 3.050000 | 20.0000 | .826 | 180 | 0 | 0 |
| 884 | ES | JS11 | METALS/SOIL/ICP | CO | 15.000000 | 5000.0000 | .608 | 180 | 0 | 0 |
| 885 | ES | JS11 | METALS/SOIL/ICP | CR | 12.700000 | 5000.0000 | .613 | 180 | 0 | 0 |
| 886 | ES | JS11 | METALS/SOIL/ICP | CU | 58.600000 | 5000.0000 | .675 | 180 | 0 | 0 |
| 887 | ES | JS11 | METALS/SOIL/ICP | FE | 50.000000 | 50000.0000 | .938 | 180 | 0 | 0 |
| 888 | ES | JS11 | METALS/SOIL/ICP | K | 37.500000 | 5000.0000 | .733 | 180 | 0 | 0 |
| 889 | ES | JS11 | METALS/SOIL/ICP | MG | 50.000000 | 50000.0000 | .988 | 180 | 0 | 0 |
| 890 | ES | JS11 | METALS/SOIL/ICP | MN | 0.275000 | 5000.0000 | .642 | 180 | 0 | 0 |
| 891 | ES | JS11 | METALS/SOIL/ICP | MO | 1.150000 | 5000.0000 | .650 | 180 | 0 | 0 |
| 892 | ES | JS11 | METALS/SOIL/ICP | NA | 150.000000 | 5000.0000 | .703 | 180 | 0 | 0 |
| 893 | ES | JS11 | METALS/SOIL/ICP | NI | 12.600000 | 5000.0000 | .593 | 180 | 0 | 0 |
| 894 | ES | JS11 | METALS/SOIL/ICP | PB | 6.620000 | 5000.0000 | 1.05 | 180 | 0 | 0 |
| 895 | ES | JS11 | METALS/SOIL/ICP | SB | 3.800000 | 5000.0000 | .581 | 180 | 0 | 0 |
| 896 | ES | JS11 | METALS/SOIL/ICP | SE | 9.530000 | 5000.0000 | .600 | 180 | 0 | 0 |
| 897 | ES | JS11 | METALS/SOIL/ICP | TE | 54.200000 | 5000.0000 | .628 | 180 | 0 | 0 |
| 898 | ES | JS11 | METALS/SOIL/ICP | TL | 31.300000 | 5000.0000 | .580 | 180 | 0 | 0 |
| 899 | ES | JS11 | METALS/SOIL/ICP | V | 13.000000 | 5000.0000 | .650 | 180 | 0 | 0 |
| 900 | ES | JS11 | METALS/SOIL/ICP | ZN | 30.200000 | 5000.0000 | .573 | 180 | 0 | 0 |
| 965 | ES | JS16 | METALS/SOIL/ICP | AG | 0.589000 | 10.0000 | 1.03 | 180 | 0 | |
| 1017 | ES | JS16 | METALS/SOIL/ICP | AL | 2.350000 | 50000.0000 | 1.01 | 180 | 0 | |
| 1018 | ES | JS16 | METALS/SOIL/ICP | AL | 2.350000 | 50000.0000 | 1.01 | 180 | 0 | 0 |
| 966 | ES | JS16 | METALS/SOIL/ICP | AS | 5.710000 | 5000.0000 | .933 | 180 | 0 | 0 |
| 967 | ES | JS16 | METALS/SOIL/ICP | B | 5.910000 | 5000.0000 | .901 | 180 | 0 | 0 |
| 968 | ES | JS16 | METALS/SOIL/ICP | BA | 5.180000 | 2500.0000 | .947 | 180 | 0 | 0 |
| 969 | ES | JS16 | METALS/SOIL/ICP | BE | 0.500000 | 1000.0000 | .956 | 180 | 0 | 0 |
| 970 | ES | JS16 | METALS/SOIL/ICP | BI | 52.800000 | 2500.0000 | .964 | 180 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|
| 1012 | ES | JS16 | METALS/SOIL/ICP | CA | 100.000000 | 50000.0000 | .965 | 180 | 0 | 0 |
| 971 | ES | JS16 | METALS/SOIL/ICP | CD | 0.700000 | 1000.0000 | .920 | 180 | 0 | 0 |
| 972 | ES | JS16 | METALS/SOIL/ICP | CO | 1.420000 | 1000.0000 | .906 | 180 | 0 | 0 |
| 973 | ES | JS16 | METALS/SOIL/ICP | CR | 4.050000 | 5000.0000 | .876 | 180 | 0 | 0 |
| 974 | ES | JS16 | METALS/SOIL/ICP | CU | 0.965000 | 2500.0000 | .958 | 180 | 0 | 0 |
| 1014 | ES | JS16 | METALS/SOIL/ICP | FE | 3.680000 | 50000.0000 | .970 | 180 | 0 | 0 |
| 1013 | ES | JS16 | METALS/SOIL/ICP | K | 100.000000 | 50000.0000 | .968 | 180 | 0 | 0 |
| | ES | JS16 | METALS/SOIL/ICP | MG | 100.000000 | 50000.0000 | .940 | 180 | 0 | 0 |
| | ES | JS16 | METALS/SOIL/ICP | MN | 2.050000 | 5000.0000 | .899 | 180 | 0 | 0 |
| | ES | JS16 | METALS/SOIL/ICP | MO | 1.120000 | 1000.0000 | .922 | 180 | 0 | 0 |
| 1016 | ES | JS16 | METALS/SOIL/ICP | NA | 100.000000 | 50000.0000 | .972 | 180 | 0 | 0 |
| 978 | ES | JS16 | METALS/SOIL/ICP | NI | 1.710000 | 5000.0000 | .870 | 180 | 0 | 0 |
| 979 | ES | JS16 | METALS/SOIL/ICP | PB | 10.500000 | 5000.0000 | .901 | 180 | 0 | 0 |
| 980 | ES | JS16 | METALS/SOIL/ICP | SB | 7.140000 | 5000.0000 | .878 | 180 | 0 | 0 |
| 981 | ES | JS16 | METALS/SOIL/ICP | SE | 2.420000 | 5000.0000 | .929 | 180 | 0 | 0 |
| 982 | ES | JS16 | METALS/SOIL/ICP | TE | 10.700000 | 1000.0000 | .904 | 180 | 0 | 0 |
| 983 | ES | JS16 | METALS/SOIL/ICP | TL | 6.620000 | 5000.0000 | .857 | 180 | 0 | 0 |
| 984 | ES | JS16 | METALS/SOIL/ICP | V | 3.390000 | 1000.0000 | .928 | 180 | 0 | 0 |
| 985 | ES | JS16 | METALS/SOIL/ICPP | ZN | 8.030000 | 5000.0000 | .888 | 180 | 0 | 0 |
| 946 | ES | JY02 | INORGANIC/SOIL/SPECTRO | CRHEX | 0.514000 | 5.0000 | .880 | 1 | 0 | 0 |
| 113 | ES | K8 | ANIONS/WATER/TECHNICON | NIT | 10.000000 | 200.0000 | 1.00 | 28 | 0 | 0 |
| 448 | ES | KF10 | ANIONS/SOIL/TECHNICON | NIT | 0.600000 | 12.0000 | 1.08 | 28 | 0 | 0 |
| 942 | ES | KF14 | INORGANIC/SOIL/TECHNICON | TPO4 | 7.490000 | 100.0000 | .953 | 28 | 0 | 0 |
| 911 | ES | KT05 | ANIONS/SOIL/IONCHROM | BR | 5.000000 | 200.0000 | .957 | 28 | 0 | 0 |
| 910 | ES | KT05 | ANIONS/SOIL/IONCHROM | CL | 6.050000 | 204.0000 | .994 | 28 | 0 | 0 |
| 908 | ES | KT05 | ANIONS/SOIL/IONCHROM | F | 3.620000 | 51.2000 | .871 | 28 | 0 | 0 |
| 909 | ES | KT05 | ANIONS/SOIL/IONCHROM | SO4 | 90.400000 | 512.0000 | .904 | 28 | 0 | 0 |
| 114 | ES | KY01 | CYANIDE/SOIL/TECHNICON | CYN | 0.920000 | 10.0000 | .924 | 14 | 0 | 0 |
| 115 | ES | L8 | METALS/WATER/CVAA | HG | 0.242000 | 10.0000 | 1.03 | 28 | 0 | 0 |
| 476 | ES | LF03 | EXPLOSIVES/SOIL/TECHNICON | NC | 10.400000 | 125.0000 | .533 | 0 | 40 | 1 |
| 116 | ES | LG01 | HALOCARBONS/SOIL/GCCON | 111TCE | 0.120000 | 0.9800 | 1.08 | 0 | 7 | 40 |
| 117 | ES | LG01 | HALOCARBONS/SOIL/GCCON | 112TCE | 0.120000 | 1.0000 | 1.09 | 0 | 7 | 40 |
| 118 | ES | LG01 | HALOCARBONS/SOIL/GCCON | 11DCE | 0.120000 | 0.9400 | 1.12 | 0 | 7 | 40 |
| 119 | ES | LG01 | HALOCARBONS/SOIL/GCCON | 11DCLE | 0.130000 | 0.9700 | 1.09 | 0 | 7 | 40 |
| 120 | ES | LG01 | HALOCARBONS/SOIL/GCCON | 12DCE | 0.150000 | 1.0200 | 1.16 | 0 | 7 | 40 |
| 121 | ES | LG01 | HALOCARBONS/SOIL/GCCON | 12DCLE | 0.080000 | 1.0000 | 1.10 | 0 | 7 | 40 |
| 122 | ES | LG01 | HALOCARBONS/SOIL/GCCON | CCL4 | 0.120000 | 1.0300 | 1.00 | 0 | 7 | 40 |
| 123 | ES | LG01 | HALOCARBONS/SOIL/GCCON | CH2CL2 | 0.150000 | 0.9900 | 1.10 | 0 | 7 | 40 |
| 124 | ES | LG01 | HALOCARBONS/SOIL/GCCON | CHCL3 | 0.100000 | 1.0400 | 1.04 | 0 | 7 | 40 |
| 125 | ES | LG01 | HALOCARBONS/SOIL/GCCON | CLC6H5 | 0.180000 | 1.0200 | 1.11 | 0 | 7 | 40 |
| 126 | ES | LG01 | HALOCARBONS/SOIL/GCCON | TCLEE | 0.120000 | 1.0100 | 1.03 | 0 | 7 | 40 |
| | ES | LG01 | HALOCARBONS/SOIL/GCCON | TRCLE | 0.090000 | 1.0000 | 1.06 | 0 | 7 | 40 |
| | ES | LH02 | HALOCARBONS/SOIL/GCCON | TRCLE | 0.023000 | 2.0000 | 1.02 | 0 | 7 | 40 |
| | ES | LH10 | PESTICIDES/SOIL/GCEC | ABHC | 0.009070 | 0.0270 | .919 | 0 | 7 | 40 |
| 703 | ES | LH10 | PESTICIDES/SOIL/GCEC | AENSLF | 0.006020 | 0.0244 | 1.03 | 0 | 7 | 40 |
| 701 | ES | LH10 | PESTICIDES/SOIL/GCEC | ALDRN | 0.007290 | 0.0257 | .988 | 0 | 7 | 40 |
| 700 | ES | LH10 | PESTICIDES/SOIL/GCEC | BBHC | 0.002570 | 0.0254 | .975 | 0 | 7 | 40 |
| 708 | ES | LH10 | PESTICIDES/SOIL/GCEC | BENSLF | 0.006630 | 0.0244 | 1.10 | 0 | 7 | 40 |
| 904 | ES | LH10 | PESTICIDES/SOIL/GCEC | CLDAN | 0.017700 | 0.1970 | .839 | 0 | 7 | 40 |
| 698 | ES | LH10 | PESTICIDES/SOIL/GCEC | DBHC | 0.005550 | 0.0252 | 1.28 | 0 | 7 | 40 |
| 705 | ES | LH10 | PESTICIDES/SOIL/GCEC | DLDRN | 0.006290 | 0.0254 | 1.04 | 0 | 7 | 40 |
| 706 | ES | LH10 | PESTICIDES/SOIL/GCEC | ENDRN | 0.006570 | 0.0252 | 1.09 | 0 | 7 | 40 |
| 710 | ES | LH10 | PESTICIDES/SOIL/GCEC | ENDRNA | 0.024000 | 0.0302 | .871 | 0 | 7 | 40 |
| 711 | ES | LH10 | PESTICIDES/SOIL/GCEC | ESFSO4 | 0.007630 | 0.0286 | 1.06 | 0 | 7 | 40 |
| 699 | ES | LH10 | PESTICIDES/SOIL/GCEC | HPCL | 0.006180 | 0.0262 | 1.04 | 0 | 7 | 40 |
| 702 | ES | LH10 | PESTICIDES/SOIL/GCEC | HPCLE | 0.006200 | 0.0260 | 1.04 | 0 | 7 | 40 |
| 903 | ES | LH10 | PESTICIDES/SOIL/GCEC | ISODR | 0.004610 | 0.0412 | .941 | 0 | 7 | 40 |
| 697 | ES | LH10 | PESTICIDES/SOIL/GCEC | LIN | 0.006380 | 0.0262 | 1.03 | 0 | 7 | 40 |
| 712 | ES | LH10 | PESTICIDES/SOIL/GCEC | MEXCLR | 0.071100 | 0.2490 | 1.20 | 0 | 7 | 40 |
| 707 | ES | LH10 | PESTICIDES/SOIL/GCEC | PPDDD | 0.008260 | 0.0246 | 1.11 | 0 | 7 | 40 |
| 704 | ES | LH10 | PESTICIDES/SOIL/GCEC | PPDDE | 0.007650 | 0.0286 | 1.06 | 0 | 7 | 40 |
| 709 | ES | LH10 | PESTICIDES/SOIL/GCEC | PPDDT | 0.007070 | 0.0281 | 1.01 | 0 | 7 | 40 |
| 713 | ES | LH10 | PESTICIDES/SOIL/GCEC | TXPHEN | 0.444000 | 1.1200 | 1.35 | 0 | 7 | 40 |
| 736 | ES | LH11 | HERBICIDES/SOIL/HPLC | 245TP | 0.008500 | 0.1090 | .907 | 0 | 7 | 40 |
| 735 | ES | LH11 | HERBICIDES/SOIL/HPLC | 24D | 0.017700 | 0.2020 | 1.08 | 0 | 7 | 40 |
| 936 | ES | LH16 | PESTICIDES/SOIL/GCEC | PCB016 | 0.066600 | 0.3670 | 1.18 | 0 | 7 | 40 |
| 937 | ES | LH16 | PESTICIDES/SOIL/GCEC | PCB260 | 0.080400 | 0.4070 | 1.06 | 0 | 7 | 40 |
| 796 | ES | LL03 | ORGANOSULFURS/SOIL/GCFP | BTZ | 1.080000 | 13.2000 | .788 | 0 | 7 | 40 |
| 795 | ES | LL03 | ORGANOSULFURS/SOIL/GCFP | CPMS | 1.080000 | 21.6000 | .999 | 0 | 7 | 40 |
| 797 | ES | LL03 | ORGANOSULFURS/SOIL/GCFP | CPMSO | 2.250000 | 45.0000 | 1.02 | 0 | 7 | 40 |
| 798 | ES | LL03 | ORGANOSULFURS/SOIL/GCFP | CPMSO2 | 2.370000 | 47.4000 | .790 | 0 | 7 | 40 |
| 794 | ES | LL03 | ORGANOSULFURS/SOIL/GCFP | DITH | 1.470000 | 11.4000 | .916 | 0 | 7 | 40 |
| 792 | ES | LL03 | ORGANOSULFURS/SOIL/GCFP | DMDS | 0.692000 | 13.8000 | .946 | 0 | 7 | 40 |
| 793 | ES | LL03 | ORGANOSULFURS/SOIL/GCFP | OXAT | 0.856000 | 17.1000 | .930 | 0 | 7 | 40 |
| 129 | ES | LM02 | VOLATILES/SOIL/GCMS | 111TCE | 0.250000 | 25.0000 | .955 | 0 | 7 | 40 |
| 130 | ES | LM02 | VOLATILES/SOIL/GCMS | 112TCE | 0.250000 | 25.0000 | 1.01 | 0 | 7 | 40 |
| | ES | LM02 | VOLATILES/SOIL/GCMS | 11DCLE | 0.250000 | 25.0000 | 1.02 | 0 | 7 | 40 |
| | ES | LM02 | VOLATILES/SOIL/GCMS | 12DCD4 | 0.850000 | 25.0000 | 1.02 | 0 | 7 | 40 |
| 133 | ES | LM02 | VOLATILES/SOIL/GCMS | 12DCE | 0.250000 | 25.0000 | 1.00 | 0 | 7 | 40 |
| 134 | ES | LM02 | VOLATILES/SOIL/GCMS | 12DCLE | 0.280000 | 25.0000 | 1.02 | 0 | 7 | 40 |
| 135 | ES | LM02 | VOLATILES/SOIL/GCMS | 13DMB | 0.250000 | 25.0000 | 1.05 | 0 | 7 | 40 |
| 136 | ES | LM02 | VOLATILES/SOIL/GCMS | BCHPD | 0.250000 | 25.0000 | 1.05 | 0 | 7 | 40 |
| 137 | ES | LM02 | VOLATILES/SOIL/GCMS | C6H6 | 0.250000 | 25.0000 | 1.06 | 0 | 7 | 40 |
| 138 | ES | LM02 | VOLATILES/SOIL/GCMS | CCL4 | 0.250000 | 25.0000 | 1.03 | 0 | 7 | 40 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 139 | ES | LM02 | VOLATILES/SOIL/GCMS | CD2CL2 | 1.100000 | 25.0000 | .995 | 0 | 7 | 40 |
| 140 | ES | LM02 | VOLATILES/SOIL/GCMS | CH2CL2 | 0.250000 | 25.0000 | .964 | 0 | 7 | 40 |
| 141 | ES | LM02 | VOLATILES/SOIL/GCMS | CHCL3 | 0.250000 | 25.0000 | 1.06 | 0 | 7 | 40 |
| 142 | ES | LM02 | VOLATILES/SOIL/GCMS | CLC6H5 | 0.250000 | 25.0000 | 1.04 | 0 | 7 | 40 |
| 143 | ES | LM02 | VOLATILES/SOIL/GCMS | DBCP | 0.330000 | 25.0000 | .980 | 0 | 7 | 40 |
| 144 | ES | LM02 | VOLATILES/SOIL/GCMS | DCPD | 0.270000 | 26.5000 | 1.07 | 0 | 7 | 40 |
| 145 | ES | LM02 | VOLATILES/SOIL/GCMS | DMDS | 0.250000 | 25.0000 | 1.03 | 0 | 7 | / |
| 146 | ES | LM02 | VOLATILES/SOIL/GCMS | ETBD10 | 0.730000 | 25.0000 | 1.06 | 0 | 7 | |
| 147 | ES | LM02 | VOLATILES/SOIL/GCMS | ETC6H5 | 0.250000 | 25.0000 | 1.06 | 0 | 7 | 4 |
| 148 | ES | LM02 | VOLATILES/SOIL/GCMS | MEC6H5 | 0.250000 | 25.0000 | 1.05 | 0 | 7 | 40 |
| 149 | ES | LM02 | VOLATILES/SOIL/GCMS | MIBK | 0.500000 | 25.0000 | .935 | 0 | 7 | 40 |
| 150 | ES | LM02 | VOLATILES/SOIL/GCMS | TCLEE | 0.250000 | 25.0000 | 1.04 | 0 | 7 | 40 |
| 151 | ES | LM02 | VOLATILES/SOIL/GCMS | TRCLE | 0.250000 | 25.0000 | 1.03 | 0 | 7 | 40 |
| 152 | ES | LM02 | VOLATILES/SOIL/GCMS | XYLEN | 0.500000 | 50.0000 | 1.09 | 0 | 7 | 40 |
| 153 | ES | LM03 | ORGANICS/SOIL/GCMS | 13DBD4 | 0.280000 | 100.0000 | .919 | 0 | 7 | 40 |
| 154 | ES | LM03 | ORGANICS/SOIL/GCMS | 2CLPD4 | 0.340000 | 25.0000 | 1.04 | 0 | 7 | 40 |
| 155 | ES | LM03 | ORGANICS/SOIL/GCMS | ALDRN | 0.940000 | 100.0000 | .877 | 0 | 7 | 40 |
| 156 | ES | LM03 | ORGANICS/SOIL/GCMS | ATZ | 0.730000 | 100.0000 | 1.02 | 0 | 7 | 40 |
| 157 | ES | LM03 | ORGANICS/SOIL/GCMS | CL6CP | 1.100000 | 50.0000 | 1.17 | 0 | 7 | 40 |
| 158 | ES | LM03 | ORGANICS/SOIL/GCMS | CLDAN | 1.000000 | 100.0000 | .937 | 0 | 7 | 40 |
| 159 | ES | LM03 | ORGANICS/SOIL/GCMS | CPMS | 0.250000 | 50.0000 | 1.04 | 0 | 7 | 40 |
| 160 | ES | LM03 | ORGANICS/SOIL/GCMS | CPMSO | 0.350000 | 50.0000 | .972 | 0 | 7 | 40 |
| 161 | ES | LM03 | ORGANICS/SOIL/GCMS | CPMSO2 | 0.290000 | 100.0000 | .898 | 0 | 7 | 40 |
| 162 | ES | LM03 | ORGANICS/SOIL/GCMS | DBCP | 0.330000 | 50.0000 | 1.03 | 0 | 7 | 40 |
| 163 | ES | LM03 | ORGANICS/SOIL/GCMS | DCPD | 0.260000 | 25.0000 | 1.04 | 0 | 7 | 40 |
| 164 | ES | LM03 | ORGANICS/SOIL/GCMS | DDVP | 0.250000 | 25.0000 | .722 | 0 | 7 | 40 |
| 165 | ES | LM03 | ORGANICS/SOIL/GCMS | DEPD4 | 0.250000 | 50.0000 | .958 | 0 | 7 | 40 |
| 166 | ES | LM03 | ORGANICS/SOIL/GCMS | DIMP | 0.500000 | 10.0000 | 1.13 | 0 | 7 | 40 |
| 167 | ES | LM03 | ORGANICS/SOIL/GCMS | DITH | 0.250000 | 100.0000 | .926 | 0 | 7 | 40 |
| 168 | ES | LM03 | ORGANICS/SOIL/GCMS | DLDRN | 0.250000 | 100.0000 | .984 | 0 | 7 | 40 |
| 169 | ES | LM03 | ORGANICS/SOIL/GCMS | DMMP | 1.500000 | 10.0000 | 1.07 | 0 | 7 | 40 |
| 170 | ES | LM03 | ORGANICS/SOIL/GCMS | DNOPD4 | 0.570000 | 100.0000 | 1.09 | 0 | 7 | 40 |
| 171 | ES | LM03 | ORGANICS/SOIL/GCMS | ENDRN | 0.700000 | 50.0000 | 1.00 | 0 | 7 | 40 |
| 172 | ES | LM03 | ORGANICS/SOIL/GCMS | ISODR | 0.330000 | 100.0000 | .939 | 0 | 7 | 40 |
| 173 | ES | LM03 | ORGANICS/SOIL/GCMS | MLTHN | 0.590000 | 2.5000 | 1.07 | 0 | 7 | 40 |
| 174 | ES | LM03 | ORGANICS/SOIL/GCMS | OXAT | 0.270000 | 100.0000 | .956 | 0 | 7 | 40 |
| 175 | ES | LM03 | ORGANICS/SOIL/GCMS | PPDDE | 0.290000 | 100.0000 | .877 | 0 | 7 | 40 |
| 176 | ES | LM03 | ORGANICS/SOIL/GCMS | PPDDT | 0.370000 | 100.0000 | 1.12 | 0 | 7 | 40 |
| 177 | ES | LM03 | ORGANICS/SOIL/GCMS | PRTHN | 0.630000 | 100.0000 | 1.06 | 0 | 7 | 40 |
| 178 | ES | LM03 | ORGANICS/SOIL/GCMS | SUPONA | 0.490000 | 10.0000 | 1.12 | 0 | 7 | 40 |
| 691 | ES | LM18 | ORGANICS/SOIL/GCMS | 124TCB | 0.040000 | 13.0000 | .801 | 0 | 7 | / |
| 692 | ES | LM18 | ORGANICS/SOIL/GCMS | 12DCLB | 0.110000 | 13.0000 | .734 | 0 | 7 | |
| 694 | ES | LM18 | ORGANICS/SOIL/GCMS | 13DCLB | 0.130000 | 13.0000 | .724 | 0 | 7 | 4. |
| 695 | ES | LM18 | ORGANICS/SOIL/GCMS | 14DCLB | 0.098000 | 13.0000 | .715 | 0 | 7 | 40 |
| 659 | ES | LM18 | ORGANICS/SOIL/GCMS | 245TCP | 0.100000 | 13.0000 | .897 | 0 | 7 | 40 |
| 631 | ES | LM18 | ORGANICS/SOIL/GCMS | 246TBP | 0.380000 | 13.0000 | .910 | 0 | 7 | 40 |
| 591 | ES | LM18 | ORGANICS/SOIL/GCMS | 246TCP | 0.170000 | 13.0000 | .948 | 0 | 7 | 40 |
| 678 | ES | LM18 | ORGANICS/SOIL/GCMS | 24DCLP | 0.180000 | 13.0000 | .909 | 0 | 7 | 40 |
| 672 | ES | LM18 | ORGANICS/SOIL/GCMS | 24DMPN | 0.690000 | 1.3000 | .917 | 0 | 7 | 40 |
| 675 | ES | LM18 | ORGANICS/SOIL/GCMS | 24DNP | 1.200000 | 6.7000 | .816 | 0 | 7 | 40 |
| 693 | ES | LM18 | ORGANICS/SOIL/GCMS | 24DNT | 0.140000 | 13.0000 | .936 | 0 | 7 | 40 |
| 589 | ES | LM18 | ORGANICS/SOIL/GCMS | 26DNT | 0.085000 | 13.0000 | .954 | 0 | 7 | 40 |
| 641 | ES | LM18 | ORGANICS/SOIL/GCMS | 2CLP | 0.060000 | 13.0000 | .745 | 0 | 7 | 40 |
| 667 | ES | LM18 | ORGANICS/SOIL/GCMS | 2CNAP | 0.036000 | 13.0000 | .847 | 0 | 7 | 40 |
| 661 | ES | LM18 | ORGANICS/SOIL/GCMS | 2FBP | 0.021000 | 6.7000 | .903 | 0 | 7 | 40 |
| 664 | ES | LM18 | ORGANICS/SOIL/GCMS | 2FP | 0.170000 | 13.0000 | .744 | 0 | 7 | 40 |
| 670 | ES | LM18 | ORGANICS/SOIL/GCMS | 2MNAP | 0.049000 | 6.7000 | .828 | 0 | 7 | 40 |
| 683 | ES | LM18 | ORGANICS/SOIL/GCMS | 2MP | 0.029000 | 1.3000 | .490 | 0 | 7 | 40 |
| 660 | ES | LM18 | ORGANICS/SOIL/GCMS | 2NANIL | 0.062000 | 13.0000 | .865 | 0 | 7 | 40 |
| 633 | ES | LM18 | ORGANICS/SOIL/GCMS | 2NP | 0.140000 | 13.0000 | .915 | 0 | 7 | 40 |
| 682 | ES | LM18 | ORGANICS/SOIL/GCMS | 33DCBD | 6.300000 | 13.0000 | .633 | 0 | 7 | 40 |
| 644 | ES | LM18 | ORGANICS/SOIL/GCMS | 3NANIL | 0.450000 | 13.0000 | .909 | 0 | 7 | 40 |
| 668 | ES | LM18 | ORGANICS/SOIL/GCMS | 46DN2C | 0.550000 | 13.0000 | 1.06 | 0 | 7 | 40 |
| 687 | ES | LM18 | ORGANICS/SOIL/GCMS | 4BRPPE | 0.033000 | 6.7000 | .921 | 0 | 7 | 40 |
| 666 | ES | LM18 | ORGANICS/SOIL/GCMS | 4CANIL | 0.810000 | 3.3000 | .517 | 0 | 7 | 40 |
| 679 | ES | LM18 | ORGANICS/SOIL/GCMS | 4CL3C | 0.095000 | 13.0000 | .894 | 0 | 7 | 40 |
| 636 | ES | LM18 | ORGANICS/SOIL/GCMS | 4CLPPE | 0.033000 | 13.0000 | .826 | 0 | 7 | 40 |
| 656 | ES | LM18 | ORGANICS/SOIL/GCMS | 4MP | 0.240000 | 1.3000 | .439 | 0 | 7 | 40 |
| 657 | ES | LM18 | ORGANICS/SOIL/GCMS | 4NANIL | 0.410000 | 13.0000 | .739 | 0 | 7 | 40 |
| 652 | ES | LM18 | ORGANICS/SOIL/GCMS | 4NP | 1.400000 | 13.0000 | .921 | 0 | 7 | 40 |
| 634 | ES | LM18 | ORGANICS/SOIL/GCMS | ANAPNE | 0.036000 | 13.0000 | .826 | 0 | 7 | 40 |
| 638 | ES | LM18 | ORGANICS/SOIL/GCMS | ANAPYL | 0.033000 | 6.7000 | .881 | 0 | 7 | 40 |
| 639 | ES | LM18 | ORGANICS/SOIL/GCMS | ANTRC | 0.033000 | 13.0000 | .870 | 0 | 7 | 40 |
| 632 | ES | LM18 | ORGANICS/SOIL/GCMS | B2CEXM | 0.059000 | 13.0000 | .863 | 0 | 7 | 40 |
| 685 | ES | LM18 | ORGANICS/SOIL/GCMS | B2CIPE | 0.200000 | 13.0000 | .819 | 0 | 7 | 40 |
| 686 | ES | LM18 | ORGANICS/SOIL/GCMS | B2CLEE | 0.033000 | 6.7000 | .802 | 0 | 7 | |
| 688 | ES | LM18 | ORGANICS/SOIL/GCMS | B2EHP | 0.620000 | 13.0000 | .974 | 0 | 7 | |
| 642 | ES | LM18 | ORGANICS/SOIL/GCMS | BAANTR | 0.170000 | 13.0000 | 1.06 | 0 | 7 | 4b |
| 643 | ES | LM18 | ORGANICS/SOIL/GCMS | BAPYR | 0.250000 | 13.0000 | .840 | 0 | 7 | 40 |
| 645 | ES | LM18 | ORGANICS/SOIL/GCMS | BBFANT | 0.210000 | 3.3000 | .785 | 0 | 7 | 40 |
| 673 | ES | LM18 | ORGANICS/SOIL/GCMS | BBZP | 0.170000 | 6.7000 | .963 | 0 | 7 | 40 |
| 647 | ES | LM18 | ORGANICS/SOIL/GCMS | BGHIPY | 0.250000 | 3.3000 | 1.02 | 0 | 7 | 40 |
| 648 | ES | LM18 | ORGANICS/SOIL/GCMS | BKFANT | 0.066000 | 0.6700 | .964 | 0 | 7 | 40 |
| 665 | ES | LM18 | ORGANICS/SOIL/GCMS | BZALC | 0.190000 | 13.0000 | .963 | 0 | 7 | 40 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 635 | ES | LM18 | ORGANICS/SOIL/GCMS | CHRY | 0.120000 | 6.7000 | .816 | 0 | 7 | 40 |
| 690 | ES | LM18 | ORGANICS/SOIL/GCMS | CL6BZ | 0.033000 | 6.7000 | .907 | 0 | 7 | 40 |
| 649 | ES | LM18 | ORGANICS/SOIL/GCMS | CL6CP | 6.200000 | 13.0000 | .131 | 0 | 7 | 40 |
| 655 | ES | LM18 | ORGANICS/SOIL/GCMS | CL6ET | 0.150000 | 13.0000 | .716 | 0 | 7 | 40 |
| 654 | ES | LM18 | ORGANICS/SOIL/GCMS | DBAHA | 0.210000 | 13.0000 | .999 | 0 | 7 | 40 |
| 637 | ES | LM18 | ORGANICS/SOIL/GCMS | DBZFUR | 0.035000 | 6.7000 | .901 | 0 | 7 | 40 |
| 677 | ES | LM18 | ORGANICS/SOIL/GCMS | DEP | 0.240000 | 6.7000 | .927 | 0 | 7 | 40 |
| | ES | LM18 | ORGANICS/SOIL/GCMS | DMP | 0.170000 | 13.0000 | .890 | 0 | 7 | 40 |
| | ES | LM18 | ORGANICS/SOIL/GCMS | DNBP | 0.061000 | 3.3000 | .935 | 0 | 7 | 40 |
| | ES | LM18 | ORGANICS/SOIL/GCMS | DNOP | 0.190000 | 6.7000 | .712 | 0 | 7 | 40 |
| 650 | ES | LM18 | ORGANICS/SOIL/GCMS | FANT | 0.068000 | 13.0000 | .863 | 0 | 7 | 40 |
| 671 | ES | LM18 | ORGANICS/SOIL/GCMS | FLRENE | 0.033000 | 13.0000 | .856 | 0 | 7 | 40 |
| 680 | ES | LM18 | ORGANICS/SOIL/GCMS | HCBD | 0.230000 | 13.0000 | .747 | 0 | 7 | 40 |
| 640 | ES | LM18 | ORGANICS/SOIL/GCMS | ICDPYR | 0.290000 | 13.0000 | .948 | 0 | 7 | 40 |
| 689 | ES | LM18 | ORGANICS/SOIL/GCMS | ISOPHR | 0.033000 | 13.0000 | .833 | 0 | 7 | 40 |
| 676 | ES | LM18 | ORGANICS/SOIL/GCMS | NAP | 0.037000 | 3.3000 | .858 | 0 | 7 | 40 |
| 653 | ES | LM18 | ORGANICS/SOIL/GCMS | NB | 0.045000 | 13.0000 | .840 | 0 | 7 | 40 |
| 684 | ES | LM18 | ORGANICS/SOIL/GCMS | NBD5 | 0.025000 | 6.7000 | .858 | 0 | 7 | 40 |
| 646 | ES | LM18 | ORGANICS/SOIL/GCMS | NNDNPA | 0.200000 | 13.0000 | .849 | 0 | 7 | 40 |
| 588 | ES | LM18 | ORGANICS/SOIL/GCMS | NNDPA | 0.190000 | 13.0000 | .848 | 0 | 7 | 40 |
| 651 | ES | LM18 | ORGANICS/SOIL/GCMS | PCP | 1.300000 | 6.7000 | .790 | 0 | 7 | 40 |
| 662 | ES | LM18 | ORGANICS/SOIL/GCMS | PHANTR | 0.033000 | 13.0000 | .969 | 0 | 7 | 40 |
| 592 | ES | LM18 | ORGANICS/SOIL/GCMS | PHEND6 | 0.230000 | 13.0000 | .824 | 0 | 7 | 40 |
| 658 | ES | LM18 | ORGANICS/SOIL/GCMS | PHENOL | 0.110000 | 3.3000 | .811 | 0 | 7 | 40 |
| 674 | ES | LM18 | ORGANICS/SOIL/GCMS | PYR | 0.033000 | 3.3000 | .845 | 0 | 7 | 40 |
| 663 | ES | LM18 | ORGANICS/SOIL/GCMS | TRPD14 | 0.340000 | 6.7000 | 1.07 | 0 | 7 | 40 |
| 597 | ES | LM19 | VOLATILES/SOIL/GCMS | 111TCE | 0.004400 | 0.2000 | 1.20 | 14 | 0 | 0 |
| 598 | ES | LM19 | VOLATILES/SOIL/GCMS | 112TCE | 0.005400 | 0.2000 | 1.10 | 14 | 0 | 0 |
| 630 | ES | LM19 | VOLATILES/SOIL/GCMS | 11DCE | 0.003900 | 0.1000 | 1.07 | 14 | 0 | 0 |
| 628 | ES | LM19 | VOLATILES/SOIL/GCMS | 11DCLE | 0.002300 | 0.2000 | 1.03 | 14 | 0 | 0 |
| 608 | ES | LM19 | VOLATILES/SOIL/GCMS | 12DCD4 | 0.003200 | 0.2000 | .995 | 14 | 0 | 0 |
| 600 | ES | LM19 | VOLATILES/SOIL/GCMS | 12DCE | 0.003000 | 0.1000 | .986 | 14 | 0 | 0 |
| 629 | ES | LM19 | VOLATILES/SOIL/GCMS | 12DCLE | 0.001700 | 0.2000 | 1.02 | 14 | 0 | 0 |
| 593 | ES | LM19 | VOLATILES/SOIL/GCMS | 12DCLP | 0.002900 | 0.2000 | 1.10 | 14 | 0 | 0 |
| 616 | ES | LM19 | VOLATILES/SOIL/GCMS | 4BFB | 0.002900 | 0.2000 | .924 | 14 | 0 | 0 |
| 596 | ES | LM19 | VOLATILES/SOIL/GCMS | ACET | 0.017000 | 0.1000 | .970 | 14 | 0 | 0 |
| 606 | ES | LM19 | VOLATILES/SOIL/GCMS | BRDCLM | 0.002900 | 0.2000 | 1.18 | 14 | 0 | 0 |
| 620 | ES | LM19 | VOLATILES/SOIL/GCMS | C13DCP | 0.003200 | 0.2480 | 1.13 | 14 | 0 | 0 |
| 601 | ES | LM19 | VOLATILES/SOIL/GCMS | C2AVE | 0.003200 | 0.1000 | 1.37 | 14 | 0 | 0 |
| 604 | ES | LM19 | VOLATILES/SOIL/GCMS | C2H3CL | 0.006200 | 0.2000 | 1.09 | 14 | 0 | 0 |
| 618 | ES | LM19 | VOLATILES/SOIL/GCMS | C2H5CL | 0.012000 | 0.2000 | 1.05 | 14 | 0 | 0 |
| | ES | LM19 | VOLATILES/SOIL/GCMS | C6H6 | 0.001500 | 0.2000 | 1.02 | 14 | 0 | 0 |
| | ES | LM19 | VOLATILES/SOIL/GCMS | CCL3F | 0.005900 | 0.1000 | 1.17 | 14 | 0 | 0 |
| | ES | LM19 | VOLATILES/SOIL/GCMS | CCL4 | 0.007000 | 0.2000 | 1.27 | 14 | 0 | 0 |
| 595 | ES | LM19 | VOLATILES/SOIL/GCMS | CH2CL2 | 0.012000 | 0.2000 | .988 | 14 | 0 | 0 |
| 610 | ES | LM19 | VOLATILES/SOIL/GCMS | CH3BR | 0.005700 | 0.2000 | .891 | 14 | 0 | 0 |
| 623 | ES | LM19 | VOLATILES/SOIL/GCMS | CH3CL | 0.008800 | 0.1000 | .882 | 14 | 0 | 0 |
| 607 | ES | LM19 | VOLATILES/SOIL/GCMS | CHBR3 | 0.006900 | 0.2000 | 1.33 | 14 | 0 | 0 |
| 619 | ES | LM19 | VOLATILES/SOIL/GCMS | CHCL3 | 0.000870 | 0.2000 | 1.03 | 14 | 0 | 0 |
| 615 | ES | LM19 | VOLATILES/SOIL/GCMS | CLC6H5 | 0.000860 | 0.2000 | 1.07 | 14 | 0 | 0 |
| 612 | ES | LM19 | VOLATILES/SOIL/GCMS | CS2 | 0.004400 | 0.1000 | .993 | 14 | 0 | 0 |
| 626 | ES | LM19 | VOLATILES/SOIL/GCMS | DBRCLM | 0.003100 | 0.2000 | 1.23 | 14 | 0 | 0 |
| 621 | ES | LM19 | VOLATILES/SOIL/GCMS | ETC6H5 | 0.001700 | 0.2000 | 1.03 | 14 | 0 | 0 |
| 609 | ES | LM19 | VOLATILES/SOIL/GCMS | MEC6D8 | 0.001500 | 0.2000 | .999 | 14 | 0 | 0 |
| 602 | ES | LM19 | VOLATILES/SOIL/GCMS | MEC6H5 | 0.000780 | 0.2000 | 1.02 | 14 | 0 | 0 |
| 611 | ES | LM19 | VOLATILES/SOIL/GCMS | MEK | 0.070000 | 0.2000 | 1.14 | 14 | 0 | 0 |
| 624 | ES | LM19 | VOLATILES/SOIL/GCMS | MIBK | 0.027000 | 0.1000 | 1.30 | 14 | 0 | 0 |
| 622 | ES | LM19 | VOLATILES/SOIL/GCMS | MNBK | 0.032000 | 0.1000 | 1.24 | 14 | 0 | 0 |
| 617 | ES | LM19 | VOLATILES/SOIL/GCMS | STYR | 0.002600 | 0.2000 | 1.03 | 14 | 0 | 0 |
| 594 | ES | LM19 | VOLATILES/SOIL/GCMS | T13DCP | 0.002800 | 0.1520 | 1.15 | 14 | 0 | 0 |
| 625 | ES | LM19 | VOLATILES/SOIL/GCMS | TCLEA | 0.002400 | 0.2000 | 1.13 | 14 | 0 | 0 |
| 627 | ES | LM19 | VOLATILES/SOIL/GCMS | TCLEE | 0.000810 | 0.2000 | 1.03 | 14 | 0 | 0 |
| 603 | ES | LM19 | VOLATILES/SOIL/GCMS | TRCLE | 0.002800 | 0.2000 | 1.16 | 14 | 0 | 0 |
| 613 | ES | LM19 | VOLATILES/SOIL/GCMS | XYLEN | 0.001500 | 0.2000 | 1.01 | 14 | 0 | 0 |
| 749 | ES | LN01 | NITROSAMINES/SOIL/GCNP | 24DNT | 0.092000 | 1.0000 | .737 | 0 | 7 | 40 |
| 748 | ES | LN01 | NITROSAMINES/SOIL/GCNP | 26DNT | 0.055800 | 1.0000 | .736 | 0 | 7 | 40 |
| 751 | ES | LN01 | NITROSAMINES/SOIL/GCNP | NB | 0.096200 | 5.0000 | .751 | 0 | 7 | 40 |
| 746 | ES | LN01 | NITROSAMINES/SOIL/GCNP | NNDMEA | 0.108000 | 0.5000 | .330 | 0 | 7 | 40 |
| 750 | ES | LN01 | NITROSAMINES/SOIL/GCNP | NNDNPA | 0.231000 | 1.0000 | .561 | 0 | 7 | 40 |
| 747 | ES | LN01 | NITROSAMINES/SOIL/GCNP | NNDPA | 0.163000 | 5.0000 | .938 | 0 | 7 | 40 |
| 916 | ES | LN05 | NP-PESTICIDES/SOIL/GCFP | ATZ | 0.250000 | 2.0000 | 1.12 | 0 | 7 | 40 |
| 919 | ES | LN05 | NP-PESTICIDES/SOIL/GCFP | DDVP | 0.452000 | 5.0000 | 1.02 | 0 | 7 | 40 |
| 917 | ES | LN05 | NP-PESTICIDES/SOIL/GCFP | MLTHN | 0.580000 | 5.0000 | 1.17 | 0 | 7 | 40 |
| 918 | ES | LN05 | NP-PESTICIDES/SOIL/GCFP | PRTHN | 0.733000 | 5.0000 | 1.23 | 0 | 7 | 40 |
| 920 | ES | LN05 | NP-PESTICIDES/SOIL/GCFP | SUPONA | 0.250000 | 5.0000 | 1.28 | 0 | 7 | 40 |
| [illegible] | ES | LO02 | VOLATILES/SOIL/GCDUAL | 111TCE | 0.040000 | 5.0000 | .988 | 14 | 0 | 0 |
| | ES | LO02 | VOLATILES/SOIL/GCDUAL | 112TCE | 0.081000 | 5.0000 | .957 | 14 | 0 | 0 |
| | ES | LO02 | VOLATILES/SOIL/GCDUAL | 11DCE | 0.051000 | 5.0000 | .941 | 14 | 0 | 0 |
| [illegible] | ES | LO02 | VOLATILES/SOIL/GCDUAL | 11DCLE | 0.055000 | 5.0000 | .948 | 14 | 0 | 0 |
| 812 | ES | LO02 | VOLATILES/SOIL/GCDUAL | 12DCLE | 0.071000 | 5.0000 | .902 | 14 | 0 | 0 |
| 813 | ES | LO02 | VOLATILES/SOIL/GCDUAL | 12DCLP | 0.043000 | 5.0000 | 1.00 | 14 | 0 | 0 |
| 814 | ES | LO02 | VOLATILES/SOIL/GCDUAL | 13DCLB | 0.032000 | 5.0000 | 1.01 | 14 | 0 | 0 |
| 815 | ES | LO02 | VOLATILES/SOIL/GCDUAL | 13DMB | 0.056000 | 5.0000 | 1.01 | 14 | 0 | 0 |
| 817 | ES | LO02 | VOLATILES/SOIL/GCDUAL | 2CLEVE | 0.075000 | 5.0000 | .799 | 14 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|
| 818 | ES | L002 | VOLATILES/SOIL/GCDUAL | BRDCLM | 0.047000 | 5.0000 | .921 | 14 | 0 | 0 |
| 819 | ES | L002 | VOLATILES/SOIL/GCDUAL | C13DCP | 0.062000 | 5.0000 | .860 | 14 | 0 | 0 |
| 820 | ES | L002 | VOLATILES/SOIL/GCDUAL | C2H3CL | 0.031000 | 5.0000 | .921 | 14 | 0 | 0 |
| 821 | ES | L002 | VOLATILES/SOIL/GCDUAL | C2H5CL | 0.029000 | 5.0000 | .961 | 14 | 0 | 0 |
| 822 | ES | L002 | VOLATILES/SOIL/GCDUAL | C6H6 | 0.085000 | 5.0000 | .952 | 14 | 0 | 0 |
| 810 | ES | L002 | VOLATILES/SOIL/GCDUAL | CCL2F2 | 0.032000 | 5.0000 | .921 | 14 | 0 | 0 |
| 865 | ES | L002 | VOLATILES/SOIL/GCDUAL | CCL3F | 0.037000 | 5.0000 | .929 | 14 | 0 | [illegible] |
| 823 | ES | L002 | VOLATILES/SOIL/GCDUAL | CCL4 | 0.044000 | 5.0000 | .965 | 14 | 0 | |
| 811 | ES | L002 | VOLATILES/SOIL/GCDUAL | CH2CL2 | 0.083000 | 5.0000 | .956 | 14 | 0 | |
| 809 | ES | L002 | VOLATILES/SOIL/GCDUAL | CH3BR | 0.031000 | 5.0000 | .899 | 14 | 0 | 0 |
| 824 | ES | L002 | VOLATILES/SOIL/GCDUAL | CH3CL | 0.180000 | 5.0000 | .933 | 14 | 0 | 0 |
| 825 | ES | L002 | VOLATILES/SOIL/GCDUAL | CHBR3 | 0.031000 | 5.0000 | .856 | 14 | 0 | 0 |
| 826 | ES | L002 | VOLATILES/SOIL/GCDUAL | CHCL3 | 0.038000 | 5.0000 | .969 | 14 | 0 | 0 |
| 816 | ES | L002 | VOLATILES/SOIL/GCDUAL | CL2BZ | 0.060000 | 10.0000 | .990 | 14 | 0 | 0 |
| 827 | ES | L002 | VOLATILES/SOIL/GCDUAL | CLC6H5 | 0.026000 | 5.0000 | .925 | 14 | 0 | 0 |
| 829 | ES | L002 | VOLATILES/SOIL/GCDUAL | DBRCLM | 0.081000 | 5.0000 | .957 | 14 | 0 | 0 |
| 830 | ES | L002 | VOLATILES/SOIL/GCDUAL | ETC6H5 | 0.062000 | 5.0000 | 1.03 | 14 | 0 | 0 |
| 831 | ES | L002 | VOLATILES/SOIL/GCDUAL | MEC6H5 | 0.028000 | 5.0000 | .970 | 14 | 0 | 0 |
| 866 | ES | L002 | VOLATILES/SOIL/GCDUAL | T12DCE | 0.063000 | 5.0000 | .948 | 14 | 0 | 0 |
| 832 | ES | L002 | VOLATILES/SOIL/GCDUAL | T13DCP | 0.081000 | 5.0000 | .957 | 14 | 0 | 0 |
| 833 | ES | L002 | VOLATILES/SOIL/GCDUAL | TCLEA | 0.045000 | 5.0000 | .906 | 14 | 0 | 0 |
| 834 | ES | L002 | VOLATILES/SOIL/GCDUAL | TCLEE | 0.045000 | 5.0000 | .906 | 14 | 0 | 0 |
| 835 | ES | L002 | VOLATILES/SOIL/GCDUAL | TRCLE | 0.049000 | 5.0000 | .972 | 14 | 0 | 0 |
| 828 | ES | L002 | VOLATILES/SOIL/GCDUAL | XYLEN | 0.086000 | 10.0000 | 1.01 | 14 | 0 | 0 |
| 179 | ES | LW03 | HERBICIDES/SOIL/HPLC | BRMCIL | 0.970000 | 20.7000 | .650 | 0 | 7 | 40 |
| 462 | ES | LW12 | EXPLOSIVES/SOIL/HPLC | 135TNB | 0.488000 | 24.4000 | .991 | 0 | 56 | 40 |
| 454 | ES | LW12 | EXPLOSIVES/SOIL/HPLC | 13DNB | 0.496000 | 24.8000 | .952 | 0 | 56 | 40 |
| 463 | ES | LW12 | EXPLOSIVES/SOIL/HPLC | 246TNT | 0.456000 | 22.8000 | 1.01 | 0 | 56 | 40 |
| 455 | ES | LW12 | EXPLOSIVES/SOIL/HPLC | 24DNT | 0.424000 | 21.2000 | .938 | 0 | 56 | 40 |
| 456 | ES | LW12 | EXPLOSIVES/SOIL/HPLC | 26DNT | 0.524000 | 26.2000 | .977 | 0 | 56 | 40 |
| 977 | ES | LW12 | EXPLOSIVES/SOIL/HPLC | 2NT | 0.307000 | 61.3000 | .997 | 0 | 7 | 40 |
| 457 | ES | LW12 | EXPLOSIVES/SOIL/HPLC | HMX | 0.666000 | 33.3000 | 1.00 | 0 | 56 | 40 |
| 458 | ES | LW12 | EXPLOSIVES/SOIL/HPLC | NB | 2.410000 | 27.4000 | .793 | 0 | 56 | 40 |
| 459 | ES | LW12 | EXPLOSIVES/SOIL/HPLC | NG | 4.000000 | 200.0000 | .931 | 0 | 56 | 40 |
| 460 | ES | LW12 | EXPLOSIVES/SOIL/HPLC | PETN | 4.000000 | 80.0000 | .969 | 0 | 56 | 40 |
| 464 | ES | LW12 | EXPLOSIVES/SOIL/HPLC | RDX | 0.587000 | 21.9000 | .929 | 0 | 56 | 40 |
| 461 | ES | LW12 | EXPLOSIVES/SOIL/HPLC | TETRYL | 0.731000 | 20.2000 | 1.13 | 0 | 56 | 40 |
| 474 | ES | LW15 | EXPLOSIVES/SOIL/HPLC | NQ | 0.475000 | 9.5000 | .901 | 0 | 56 | 40 |
| 901 | ES | LW18 | AGENTPRODS/SOIL/HPLC | CLC2A | 18.000000 | 302.0000 | .837 | 0 | 7 | 40 |
| 902 | ES | LW18 | AGENTPRODS/SOIL/HPLC | TDGCL | 3.940000 | 102.0000 | 1.07 | 7 | 40 | 0 |
| 932 | ES | LW24 | PHENOLS/SOIL/HPLC UV | 24DCLP | 0.023000 | 4.1200 | .799 | 28 | 0 | [illegible] |
| 933 | ES | LW24 | PHENOLS/SOIL/HPLC UV | 2NP | 0.043000 | 2.5000 | .771 | 28 | 0 | |
| 931 | ES | LW24 | PHENOLS/SOIL/HPLC UV | 4CL3C | 0.021000 | 4.0200 | .784 | 28 | 0 | |
| 934 | ES | LW24 | PHENOLS/SOIL/HPLC UV | CL3P | 0.040000 | 5.0600 | .798 | 28 | 0 | 0 |
| 180 | ES | M8 | VOLATILES/WATER/GCMS | 111TCE | 1.000000 | 160.0000 | .987 | 14 | 0 | 0 |
| 181 | ES | M8 | VOLATILES/WATER/GCMS | 112TCE | 1.000000 | 160.0000 | 1.06 | 14 | 0 | 0 |
| 182 | ES | M8 | VOLATILES/WATER/GCMS | 11DCLE | 2.000000 | 80.0000 | 1.00 | 14 | 0 | 0 |
| 183 | ES | M8 | VOLATILES/WATER/GCMS | 12DCD4 | 2.900000 | 160.0000 | 1.02 | 14 | 0 | 0 |
| 184 | ES | M8 | VOLATILES/WATER/GCMS | 12DCE | 1.200000 | 160.0000 | .950 | 14 | 0 | 0 |
| 185 | ES | M8 | VOLATILES/WATER/GCMS | 12DCLE | 1.000000 | 160.0000 | .979 | 14 | 0 | 0 |
| 186 | ES | M8 | VOLATILES/WATER/GCMS | 13DMB | 1.000000 | 160.0000 | .983 | 14 | 0 | 0 |
| 187 | ES | M8 | VOLATILES/WATER/GCMS | BCHPD | 1.000000 | 160.0000 | .989 | 14 | 0 | 0 |
| 188 | ES | M8 | VOLATILES/WATER/GCMS | C6H6 | 1.100000 | 160.0000 | 1.03 | 14 | 0 | 0 |
| 189 | ES | M8 | VOLATILES/WATER/GCMS | CCL4 | 1.500000 | 160.0000 | .980 | 14 | 0 | 0 |
| 190 | ES | M8 | VOLATILES/WATER/GCMS | CD2CL2 | 2.000000 | 160.0000 | .950 | 14 | 0 | 0 |
| 191 | ES | M8 | VOLATILES/WATER/GCMS | CH2CL2 | 4.800000 | 160.0000 | .888 | 14 | 0 | 0 |
| 192 | ES | M8 | VOLATILES/WATER/GCMS | CHCL3 | 1.000000 | 160.0000 | .961 | 14 | 0 | 0 |
| 193 | ES | M8 | VOLATILES/WATER/GCMS | CLC6H5 | 2.100000 | 160.0000 | 1.02 | 14 | 0 | 0 |
| 194 | ES | M8 | VOLATILES/WATER/GCMS | DBCP | 4.000000 | 80.0000 | 1.01 | 14 | 0 | 0 |
| 195 | ES | M8 | VOLATILES/WATER/GCMS | DCPD | 1.100000 | 170.0000 | .985 | 14 | 0 | 0 |
| 196 | ES | M8 | VOLATILES/WATER/GCMS | DMDS | 2.500000 | 160.0000 | 1.03 | 14 | 0 | 0 |
| 197 | ES | M8 | VOLATILES/WATER/GCMS | ETBD10 | 1.000000 | 160.0000 | 1.00 | 14 | 0 | 0 |
| 198 | ES | M8 | VOLATILES/WATER/GCMS | ETC6H5 | 1.000000 | 160.0000 | .994 | 14 | 0 | 0 |
| 199 | ES | M8 | VOLATILES/WATER/GCMS | MEC6H5 | 1.000000 | 160.0000 | .997 | 14 | 0 | 0 |
| 200 | ES | M8 | VOLATILES/WATER/GCMS | MIBK | 2.000000 | 80.0000 | 1.07 | 14 | 0 | 0 |
| 201 | ES | M8 | VOLATILES/WATER/GCMS | TCLEE | 1.000000 | 160.0000 | 1.02 | 14 | 0 | 0 |
| 202 | ES | M8 | VOLATILES/WATER/GCMS | TRCLE | 1.000000 | 160.0000 | 1.01 | 14 | 0 | 0 |
| 203 | ES | M8 | VOLATILES/WATER/GCMS | XYLEN | 2.000000 | 320.0000 | 1.02 | 14 | 0 | 0 |
| 204 | ES | MM9 | AGENTPRODS/SOIL/HPLC | CLC2A | 18.000000 | 302.0000 | .875 | 0 | 7 | 40 |
| 205 | ES | MM9 | AGENTPRODS/SOIL/HPLC | TDGCL | 2.550000 | 102.0000 | 1.07 | 0 | 7 | 40 |
| 206 | ES | O9 | ORGANICS/SOIL/GCMS | 13DBD4 | 0.270000 | 100.0000 | .919 | 0 | 7 | 40 |
| 207 | ES | O9 | ORGANICS/SOIL/GCMS | 2CLPD4 | 0.340000 | 25.0000 | 1.04 | 0 | 7 | 40 |
| 208 | ES | O9 | ORGANICS/SOIL/GCMS | ALDRN | 0.940000 | 100.0000 | .877 | 0 | 7 | 40 |
| 209 | ES | O9 | ORGANICS/SOIL/GCMS | ATZ | 0.730000 | 100.0000 | 1.02 | 0 | 7 | 40 |
| 210 | ES | O9 | ORGANICS/SOIL/GCMS | CL6CP | 1.100000 | 50.0000 | 1.18 | 0 | 7 | 40 |
| 211 | ES | O9 | ORGANICS/SOIL/GCMS | CLDAN | 1.500000 | 100.0000 | .937 | 0 | 7 | [illegible] |
| 212 | ES | O9 | ORGANICS/SOIL/GCMS | CPMS | 0.250000 | 50.0000 | 1.04 | 0 | 7 | |
| 213 | ES | O9 | ORGANICS/SOIL/GCMS | CPMSO | 0.350000 | 50.0000 | .972 | 0 | 7 | [illegible] |
| 214 | ES | O9 | ORGANICS/SOIL/GCMS | CPMSO2 | 0.290000 | 100.0000 | .898 | 0 | 7 | 40 |
| 215 | ES | O9 | ORGANICS/SOIL/GCMS | DBCP | 0.330000 | 50.0000 | 1.04 | 0 | 7 | 40 |
| 216 | ES | O9 | ORGANICS/SOIL/GCMS | DCPD | 0.260000 | 25.0000 | 1.03 | 0 | 7 | 40 |
| 217 | ES | O9 | ORGANICS/SOIL/GCMS | DDVP | 0.250000 | 25.0000 | .722 | 0 | 7 | 40 |
| 218 | ES | O9 | ORGANICS/SOIL/GCMS | DEPD4 | 0.250000 | 50.0000 | .958 | 0 | 7 | 40 |
| 219 | ES | O9 | ORGANICS/SOIL/GCMS | DIMP | 0.500000 | 10.0000 | 1.13 | 0 | 7 | 40 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 220 | ES | Q9 | ORGANICS/SOIL/GCMS | DITH | 0.250000 | 100.0000 | .926 | 0 | 7 | 40 |
| 221 | ES | Q9 | ORGANICS/SOIL/GCMS | DLDRN | 0.250000 | 100.0000 | .984 | 0 | 7 | 40 |
| 222 | ES | Q9 | ORGANICS/SOIL/GCMS | DMMP | 1.500000 | 10.0000 | 1.07 | 0 | 7 | 40 |
| 223 | ES | Q9 | ORGANICS/SOIL/GCMS | DNOPD4 | 0.570000 | 100.0000 | 1.09 | 0 | 7 | 40 |
| 224 | ES | Q9 | ORGANICS/SOIL/GCMS | ENDRN | 0.700000 | 50.0000 | 1.00 | 0 | 7 | 40 |
| 225 | ES | Q9 | ORGANICS/SOIL/GCMS | ISODR | 0.330000 | 100.0000 | .939 | 0 | 7 | 40 |
| [illegible]6 | ES | Q9 | ORGANICS/SOIL/GCMS | MLTHN | 0.590000 | 2.5000 | 1.07 | 0 | 7 | 40 |
| | ES | Q9 | ORGANICS/SOIL/GCMS | OXAT | 0.260000 | 100.0000 | .956 | 0 | 7 | 40 |
| | ES | Q9 | ORGANICS/SOIL/GCMS | PPDDE | 0.290000 | 100.0000 | .877 | 0 | 7 | 40 |
| [illegible]9 | ES | Q9 | ORGANICS/SOIL/GCMS | PPDDT | 0.370000 | 100.0000 | 1.12 | 0 | 7 | 40 |
| 230 | ES | Q9 | ORGANICS/SOIL/GCMS | PRTHN | 0.630000 | 100.0000 | 1.06 | 0 | 7 | 40 |
| 231 | ES | Q9 | ORGANICS/SOIL/GCMS | SUPONA | 0.490000 | 10.0000 | 1.12 | 0 | 7 | 40 |
| 232 | ES | R9 | METALS/SOIL/ICP | CD | 0.921000 | 50.0000 | 1.12 | 180 | 0 | 0 |
| 233 | ES | R9 | METALS/SOIL/ICP | CR | 7.160000 | 500.0000 | .926 | 180 | 0 | 0 |
| 234 | ES | R9 | METALS/SOIL/ICP | CU | 4.810000 | 500.0000 | 1.01 | 180 | 0 | 0 |
| 235 | ES | R9 | METALS/SOIL/ICP | PB | 16.800000 | 500.0000 | .919 | 180 | 0 | 0 |
| 236 | ES | R9 | METALS/SOIL/ICP | ZN | 16.400000 | 500.0000 | 1.03 | 180 | 0 | 0 |
| 237 | ES | S8 | PESTICIDES/WATER/GCEC | ALDRN | 0.070000 | 1.0200 | .889 | 0 | 7 | 40 |
| 238 | ES | S8 | PESTICIDES/WATER/GCEC | CL6CP | 0.070000 | 0.9900 | .779 | 0 | 7 | 40 |
| 239 | ES | S8 | PESTICIDES/WATER/GCEC | DLDRN | 0.060000 | 1.0400 | .981 | 0 | 7 | 40 |
| 240 | ES | S8 | PESTICIDES/WATER/GCEC | ENDRN | 0.052000 | 1.0300 | 1.10 | 0 | 7 | 40 |
| 241 | ES | S8 | PESTICIDES/WATER/GCEC | ISODR | 0.060000 | 1.1000 | .910 | 0 | 7 | 40 |
| 242 | ES | S8 | PESTICIDES/WATER/GCEC | PPDDE | 0.053000 | 1.0600 | .981 | 0 | 7 | 40 |
| 243 | ES | S8 | PESTICIDES/WATER/GCEC | PPDDT | 0.070000 | 1.0800 | 1.07 | 0 | 7 | 40 |
| 244 | ES | SB01 | METALS/WATER/CVAA | HG | 0.243000 | 10.0000 | 1.03 | 28 | 0 | 0 |
| 245 | ES | SD02 | METALS/WATER/GFAA | SE | 5.220000 | 25.0000 | 1.08 | 180 | 0 | 0 |
| 246 | ES | SD03 | METALS/WATER/GFAA | AS | 3.880000 | 50.0000 | .976 | 180 | 0 | 0 |
| 443 | ES | SD09 | METALS/WATER/GFAA | AG | 0.280000 | 2.0000 | 1.02 | 180 | 0 | 0 |
| 433 | ES | SD09 | METALS/WATER/GFAA | AL | 31.000000 | 300.0000 | 1.12 | 180 | 0 | 0 |
| 435 | ES | SD09 | METALS/WATER/GFAA | AS | 14.100000 | 200.0000 | 1.41 | 180 | 0 | 0 |
| 436 | ES | SD09 | METALS/WATER/GFAA | BE | 2.950000 | 10.0000 | 1.20 | 180 | 0 | 0 |
| 437 | ES | SD09 | METALS/WATER/GFAA | CD | 7.400000 | 50.0000 | 1.10 | 180 | 0 | 0 |
| 439 | ES | SD09 | METALS/WATER/GFAA | MN | 5.930000 | 10.0000 | 1.18 | 180 | 0 | 0 |
| 440 | ES | SD09 | METALS/WATER/GFAA | MO | 12.700000 | 75.0000 | .995 | 180 | 0 | 0 |
| 441 | ES | SD09 | METALS/WATER/GFAA | NI | 37.800000 | 375.0000 | 1.27 | 180 | 0 | 0 |
| 438 | ES | SD09 | METALS/WATER/GFAA | PB | 22.200000 | 300.0000 | .948 | 180 | 0 | 0 |
| 434 | ES | SD09 | METALS/WATER/GFAA | SB | 23.800000 | 300.0000 | 1.30 | 180 | 0 | 0 |
| 442 | ES | SD09 | METALS/WATER/GFAA | SE | 9.660000 | 100.0000 | 1.37 | 180 | 0 | 0 |
| 444 | ES | SD09 | METALS/WATER/GFAA | TL | 6.990000 | 25.0000 | .905 | 180 | 0 | 0 |
| 445 | ES | SD09 | METALS/WATER/GFAA | ZN | 25.200000 | 50.0000 | .762 | 180 | 0 | 0 |
| [illegible] | ES | SD19 | METALS/WATER/GFAA | V | 3.820000 | 200.0000 | .909 | 180 | 0 | 0 |
| | ES | SD20 | METALS/WATER/GFAA | PB | 1.260000 | 100.0000 | .922 | 180 | 0 | 0 |
| | ES | SD21 | METALS/WATER/GFAA | SE | 3.020000 | 100.0000 | .939 | 180 | 0 | 0 |
| 744 | ES | SD22 | METALS/WATER/GFAA | AS | 2.540000 | 100.0000 | .938 | 180 | 0 | 0 |
| 745 | ES | SD23 | METALS/WATER/GFAA | AG | 0.250000 | 10.0000 | 1.06 | 180 | 0 | 0 |
| 947 | ES | SD28 | METALS/WATER/GFAA | SB | 3.030000 | 200.0000 | 1.12 | 180 | 0 | 0 |
| 247 | ES | SS01 | METALS/WATER/ICP | AG | 13.500000 | 5000.0000 | .964 | 180 | 0 | 0 |
| 248 | ES | SS01 | METALS/WATER/ICP | BA | 10.400000 | 10000.0000 | .999 | 180 | 0 | 0 |
| 249 | ES | SS01 | METALS/WATER/ICP | CA | 500.000000 | 20000.0000 | .974 | 180 | 0 | 0 |
| 250 | ES | SS01 | METALS/WATER/ICP | CD | 5.160000 | 5000.0000 | 1.00 | 180 | 0 | 0 |
| 251 | ES | SS01 | METALS/WATER/ICP | CR | 5.960000 | 5000.0000 | 1.01 | 180 | 0 | 0 |
| 252 | ES | SS01 | METALS/WATER/ICP | CU | 7.930000 | 10000.0000 | .985 | 180 | 0 | 0 |
| 253 | ES | SS01 | METALS/WATER/ICP | MG | 500.000000 | 20000.0000 | .988 | 180 | 0 | 0 |
| 254 | ES | SS01 | METALS/WATER/ICP | NA | 764.000000 | 50000.0000 | .954 | 180 | 0 | 0 |
| 255 | ES | SS01 | METALS/WATER/ICP | PB | 18.600000 | 5000.0000 | .945 | 180 | 0 | 0 |
| 256 | ES | SS01 | METALS/WATER/ICP | ZN | 20.100000 | 20000.0000 | .949 | 180 | 0 | 0 |
| 928 | ES | SS10 | METALS/WATER/ICP | AG | 4.600000 | 2500.0000 | .989 | 180 | 0 | 0 |
| 761 | ES | SS10 | METALS/WATER/ICP | AL | 141.000000 | 500000.0000 | 1.01 | 180 | 0 | 0 |
| 762 | ES | SS10 | METALS/WATER/ICP | B | 50.000000 | 50000.0000 | .880 | 180 | 0 | 0 |
| 763 | ES | SS10 | METALS/WATER/ICP | BA | 5.000000 | 10000.0000 | 1.08 | 180 | 0 | 0 |
| 764 | ES | SS10 | METALS/WATER/ICP | BE | 5.000000 | 1000.0000 | .893 | 180 | 0 | 0 |
| 765 | ES | SS10 | METALS/WATER/ICP | BI | 109.000000 | 25000.0000 | 1.02 | 180 | 0 | 0 |
| 766 | ES | SS10 | METALS/WATER/ICP | CA | 500.000000 | 500000.0000 | .947 | 180 | 0 | 0 |
| 767 | ES | SS10 | METALS/WATER/ICP | CD | 4.010000 | 5000.0000 | 1.00 | 180 | 0 | 0 |
| 768 | ES | SS10 | METALS/WATER/ICP | CO | 25.000000 | 50000.0000 | .879 | 180 | 0 | 0 |
| 769 | ES | SS10 | METALS/WATER/ICP | CR | 6.020000 | 5000.0000 | 1.01 | 180 | 0 | 0 |
| 770 | ES | SS10 | METALS/WATER/ICP | CU | 8.090000 | 10000.0000 | .985 | 180 | 0 | 0 |
| 771 | ES | SS10 | METALS/WATER/ICP | FE | 38.800000 | 500000.0000 | .938 | 180 | 0 | 0 |
| 772 | ES | SS10 | METALS/WATER/ICP | K | 375.000000 | 500000.0000 | .881 | 180 | 0 | 0 |
| 773 | ES | SS10 | METALS/WATER/ICP | MG | 500.000000 | 500000.0000 | .988 | 180 | 0 | 0 |
| 774 | ES | SS10 | METALS/WATER/ICP | MN | 2.750000 | 50000.0000 | .963 | 180 | 0 | 0 |
| 775 | ES | SS10 | METALS/WATER/ICP | MO | 15.300000 | 8000.0000 | .883 | 180 | 0 | 0 |
| 776 | ES | SS10 | METALS/WATER/ICP | NA | 500.000000 | 500000.0000 | .954 | 180 | 0 | 0 |
| 777 | ES | SS10 | METALS/WATER/ICP | NI | 34.300000 | 15000.0000 | .860 | 180 | 0 | 0 |
| 778 | ES | SS10 | METALS/WATER/ICP | PB | 18.600000 | 5000.0000 | .945 | 180 | 0 | 0 |
| | ES | SS10 | METALS/WATER/ICP | SB | 38.000000 | 6000.0000 | .844 | 180 | 0 | 0 |
| | ES | SS10 | METALS/WATER/ICP | SE | 71.100000 | 75000.0000 | .928 | 180 | 0 | 0 |
| | ES | SS10 | METALS/WATER/ICP | SN | 47.100000 | 200.0000 | 1.00 | 180 | 0 | 0 |
| 781 | ES | SS10 | METALS/WATER/ICP | TE | 103.000000 | 2000.0000 | .994 | 180 | 0 | 0 |
| 782 | ES | SS10 | METALS/WATER/ICP | TL | 81.400000 | 40000.0000 | .857 | 180 | 0 | 0 |
| 783 | ES | SS10 | METALS/WATER/ICP | V | 11.000000 | 1000.0000 | .958 | 180 | 0 | 0 |
| 784 | ES | SS10 | METALS/WATER/ICP | ZN | 21.100000 | 20000.0000 | .949 | 180 | 0 | 0 |
| 986 | ES | SS18 | METALS/WATER/ICP | AG | 4.420000 | 1000.0000 | 1.05 | 180 | 0 | 0 |
| 987 | ES | SS18 | METALS/WATER/ICP | AL | 23.500000 | 500000.0000 | 1.01 | 180 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 988 | ES | SS18 | METALS/WATER/ICP | AS | 34.500000 | 50000.0000 | 1.02 | 180 | 0 | 0 |
| 989 | ES | SS18 | METALS/WATER/ICP | B | 50.000000 | 50000.0000 | .936 | 180 | 0 | 0 |
| 990 | ES | SS18 | METALS/WATER/ICP | BA | 2.500000 | 25000.0000 | .999 | 180 | 0 | 0 |
| 991 | ES | SS18 | METALS/WATER/ICP | BE | 5.000000 | 10000.0000 | 1.01 | 180 | 0 | 0 |
| 992 | ES | SS18 | METALS/WATER/ICP | BI | 109.000000 | 25000.0000 | 1.02 | 180 | 0 | 0 |
| 993 | ES | SS18 | METALS/WATER/ICP | CA | 1000.000000 | 500000.0000 | .965 | 180 | 0 | 0 |
| 994 | ES | SS18 | METALS/WATER/ICP | CD | 3.010000 | 10000.0000 | .995 | 180 | 0 | [illegible] |
| 995 | ES | SS18 | METALS/WATER/ICP | CO | 25.000000 | 50000.0000 | .879 | 180 | 0 | |
| 996 | ES | SS18 | METALS/WATER/ICP | CR | 6.960000 | 50000.0000 | .947 | 180 | 0 | [illegible] |
| 997 | ES | SS18 | METALS/WATER/ICP | CU | 5.000000 | 25000.0000 | 1.00 | 180 | 0 | 0 |
| 998 | ES | SS18 | METALS/WATER/ICP | FE | 36.800000 | 500000.0000 | .970 | 180 | 0 | 0 |
| 999 | ES | SS18 | METALS/WATER/ICP | K | 1000.000000 | 500000.0000 | .968 | 180 | 0 | 0 |
| 1000 | ES | SS18 | METALS/WATER/ICP | MG | 378.000000 | 500000.0000 | .938 | 180 | 0 | 0 |
| 1001 | ES | SS18 | METALS/WATER/ICP | MN | 2.500000 | 50000.0000 | .963 | 180 | 0 | 0 |
| 1002 | ES | SS18 | METALS/WATER/ICP | MO | 10.000000 | 10000.0000 | .998 | 180 | 0 | 0 |
| 1003 | ES | SS18 | METALS/WATER/ICP | NA | 2290.000000 | 500000.0000 | .972 | 180 | 0 | 0 |
| 1004 | ES | SS18 | METALS/WATER/ICP | NI | 7.110000 | 50000.0000 | .939 | 180 | 0 | 0 |
| 1005 | ES | SS18 | METALS/WATER/ICP | PB | 25.000000 | 5000.0000 | .945 | 180 | 0 | 0 |
| 1006 | ES | SS18 | METALS/WATER/ICP | SB | 29.500000 | 6000.0000 | .844 | 180 | 0 | 0 |
| 1007 | ES | SS18 | METALS/WATER/ICP | SE | 50.000000 | 50000.0000 | 1.02 | 180 | 0 | 0 |
| 1008 | ES | SS18 | METALS/WATER/ICP | TE | 103.000000 | 2000.0000 | .994 | 180 | 0 | 0 |
| 1009 | ES | SS18 | METALS/WATER/ICP | TL | 50.000000 | 50000.0000 | .963 | 180 | 0 | 0 |
| 1010 | ES | SS18 | METALS/WATER/ICP | V | 4.690000 | 10000.0000 | 1.00 | 180 | 0 | 0 |
| 1011 | ES | SS18 | METALS/WATER/ICP | ZN | 35.800000 | 10000.0000 | .993 | 180 | 0 | 0 |
| 257 | ES | SS9 | PESTICIDES/SOIL/GCEC | ALDRN | 0.050000 | 1.0000 | .859 | 0 | 7 | 40 |
| 258 | ES | SS9 | PESTICIDES/SOIL/GCEC | CL6CP | 0.051000 | 1.0100 | 1.05 | 0 | 7 | 40 |
| 259 | ES | SS9 | PESTICIDES/SOIL/GCEC | CLDAN | 0.203000 | 4.0500 | .970 | 0 | 7 | 40 |
| 260 | ES | SS9 | PESTICIDES/SOIL/GCEC | DLDRN | 0.051000 | 1.0100 | .895 | 0 | 7 | 40 |
| 261 | ES | SS9 | PESTICIDES/SOIL/GCEC | ENDRN | 0.060000 | 1.0400 | .878 | 0 | 7 | 40 |
| 262 | ES | SS9 | PESTICIDES/SOIL/GCEC | ISODR | 0.053000 | 1.0700 | .873 | 0 | 7 | 40 |
| 263 | ES | SS9 | PESTICIDES/SOIL/GCEC | PPDDE | 0.053000 | 1.0500 | .904 | 0 | 7 | 40 |
| 264 | ES | SS9 | PESTICIDES/SOIL/GCEC | PPDDT | 0.050000 | 1.0100 | .854 | 0 | 7 | 40 |
| 265 | ES | SS9A | PESTICIDES/SOIL/GCEC | ALDRN | 0.001820 | 0.0400 | .845 | 0 | 7 | 40 |
| 266 | ES | SS9A | PESTICIDES/SOIL/GCEC | CL6CP | 0.002580 | 0.0400 | .794 | 0 | 7 | 40 |
| 267 | ES | SS9A | PESTICIDES/SOIL/GCEC | CLDAN | 0.111000 | 0.4360 | .821 | 0 | 7 | 40 |
| 268 | ES | SS9A | PESTICIDES/SOIL/GCEC | DLDRN | 0.001210 | 0.0408 | .941 | 0 | 7 | 40 |
| 269 | ES | SS9A | PESTICIDES/SOIL/GCEC | ENDRN | 0.001000 | 0.0404 | .927 | 0 | 7 | 40 |
| 270 | ES | SS9A | PESTICIDES/SOIL/GCEC | ISODR | 0.001110 | 0.0412 | .889 | 0 | 7 | 40 |
| 271 | ES | SS9A | PESTICIDES/SOIL/GCEC | PPDDE | 0.001000 | 0.0400 | .953 | 0 | 7 | 40 |
| 272 | ES | SS9A | PESTICIDES/SOIL/GCEC | PPDDT | 0.002340 | 0.0412 | .994 | 0 | 7 | 40 |
| 273 | ES | T8 | ORGANOPHOSPHOR/WATER/GCFP | DIMP | 10.500000 | 210.0000 | .912 | 40 | 0 | [illegible] |
| 274 | ES | T8 | ORGANOPHOSPHOR/WATER/GCFP | DMMP | 15.200000 | 305.0000 | .968 | 40 | 0 | |
| 275 | ES | T9 | METALS/SOIL/GFAA | AS | 4.700000 | 50.0000 | .963 | 180 | 0 | [illegible] |
| 449 | ES | TF18 | CYANIDE/WATER/TECHNICON | CYN | 2.500000 | 50.0000 | 1.00 | 14 | 0 | 0 |
| 935 | ES | TF21 | ANIONS/WATER/TECHNICON | PO4ORT | 11.000000 | 500.0000 | 1.00 | 2 | 0 | 0 |
| 804 | ES | TF22 | NIT/WATER/TECHNICON | NIT | 10.000000 | 200.0000 | .999 | 28 | 0 | 0 |
| 905 | ES | TF25 | AMMONIUM/WATER/TECHNICON | NH3 | 60.000000 | 1000.0000 | 1.10 | 28 | 0 | 0 |
| 906 | ES | TF26 | TOTAL NITROGEN/WATER/TECH | N2KJEL | 183.000000 | 5000.0000 | 1.05 | 28 | 0 | 0 |
| 907 | ES | TF27 | PHOSHATES/WATER/TECHNICON | PO4 | 13.300000 | 500.0000 | 1.01 | 28 | 0 | 0 |
| 912 | ES | TT10 | ANIONS/WATER/IONCHROM | BR | 1000.000000 | 25000.0000 | 1.03 | 28 | 0 | 0 |
| 913 | ES | TT10 | ANIONS/WATER/IONCHROM | CL | 2120.000000 | 30000.0000 | .911 | 28 | 0 | 0 |
| 914 | ES | TT10 | ANIONS/WATER/IONCHROM | F | 1230.000000 | 10000.0000 | 1.03 | 28 | 0 | 0 |
| 915 | ES | TT10 | ANIONS/WATER/IONCHROM | SO4 | 10000.000000 | 300000.0000 | 1.00 | 28 | 0 | 0 |
| 276 | ES | TT9 | ORGANOPHOSPHOR/SOIL/GCFP | DIMP | 0.114000 | 4.5700 | 1.07 | 0 | 7 | 40 |
| 277 | ES | TT9 | ORGANOPHOSPHOR/SOIL/GCFP | DMMP | 0.133000 | 4.1800 | 1.04 | 0 | 7 | 40 |
| 929 | ES | TY10 | SULFIDE/WATER/SPECTRO | SULFID | 32.027000 | 750.0000 | 1.00 | 7 | 0 | 0 |
| 278 | ES | U8 | ORGANOSULFURS/WATER/GCFP | BTZ | 1.970000 | 42.2000 | .921 | 0 | 7 | 40 |
| 279 | ES | U8 | ORGANOSULFURS/WATER/GCFP | CPMS | 1.260000 | 25.3000 | .824 | 0 | 7 | 40 |
| 280 | ES | U8 | ORGANOSULFURS/WATER/GCFP | CPMSO | 4.230000 | 106.0000 | .743 | 0 | 7 | 40 |
| 281 | ES | U8 | ORGANOSULFURS/WATER/GCFP | CPMSO2 | 4.660000 | 106.0000 | .866 | 0 | 7 | 40 |
| 282 | ES | U8 | ORGANOSULFURS/WATER/GCFP | DITH | 1.110000 | 22.2000 | .832 | 0 | 7 | 40 |
| 283 | ES | U8 | ORGANOSULFURS/WATER/GCFP | DMDS | 1.770000 | 22.8000 | .801 | 0 | 7 | 40 |
| 284 | ES | U8 | ORGANOSULFURS/WATER/GCFP | OXAT | 1.610000 | 39.5000 | .829 | 0 | 7 | 40 |
| 285 | ES | U9 | PESTICIDES/SOIL/GCEC | DBCP | 0.005000 | 0.1000 | .755 | 0 | 7 | 40 |
| 477 | ES | UF03 | NC/WATER/TECHNICON | NC | 553.000000 | 6000.0000 | .826 | 0 | 7 | 40 |
| 286 | ES | UG02 | HALOCARBONS/WATER/GCCON | 111TCE | 1.700000 | 196.0000 | 1.15 | 14 | 0 | 0 |
| 287 | ES | UG02 | HALOCARBONS/WATER/GCCON | 112TCE | 1.000000 | 196.0000 | 1.03 | 14 | 0 | 0 |
| 288 | ES | UG02 | HALOCARBONS/WATER/GCCON | 11DCE | 1.100000 | 196.0000 | 1.17 | 14 | 0 | 0 |
| 289 | ES | UG02 | HALOCARBONS/WATER/GCCON | 11DCLE | 1.200000 | 194.0000 | 1.15 | 14 | 0 | 0 |
| 290 | ES | UG02 | HALOCARBONS/WATER/GCCON | 12DCE | 1.200000 | 194.0000 | 1.17 | 14 | 0 | 0 |
| 291 | ES | UG02 | HALOCARBONS/WATER/GCCON | 12DCLE | 0.610000 | 196.0000 | 1.03 | 14 | 0 | 0 |
| 292 | ES | UG02 | HALOCARBONS/WATER/GCCON | CCL4 | 2.400000 | 200.0000 | 1.01 | 14 | 0 | 0 |
| 293 | ES | UG02 | HALOCARBONS/WATER/GCCON | CH2CL2 | 5.000000 | 198.0000 | 1.03 | 14 | 0 | 0 |
| 294 | ES | UG02 | HALOCARBONS/WATER/GCCON | CHCL3 | 1.400000 | 194.0000 | 1.17 | 14 | 0 | 0 |
| 295 | ES | UG02 | HALOCARBONS/WATER/GCCON | CLC6H5 | 0.580000 | 200.0000 | 1.08 | 14 | 0 | 0 |
| 296 | ES | UG02 | HALOCARBONS/WATER/GCCON | TCLEE | 1.300000 | 196.0000 | 1.06 | 14 | 0 | [illegible] |
| 297 | ES | UG02 | HALOCARBONS/WATER/GCCON | TRCLE | 1.100000 | 194.0000 | 1.10 | 14 | 0 | |
| 298 | ES | UH02 | PESTICIDES/WATER/GCEC | PCB016 | 0.160000 | 6.4000 | .826 | 0 | 7 | 40 |
| 299 | ES | UH02 | PESTICIDES/WATER/GCEC | PCB260 | 0.190000 | 6.3000 | .915 | 0 | 7 | 40 |
| 714 | ES | UH13 | PESTICIDES/WATER/GCEC | ABHC | 0.030500 | 0.6380 | .941 | 0 | 7 | 40 |
| 721 | ES | UH13 | PESTICIDES/WATER/GCEC | AENSLF | 0.023000 | 0.5750 | 1.02 | 0 | 7 | 40 |
| 719 | ES | UH13 | PESTICIDES/WATER/GCEC | ALDRN | 0.091800 | 0.6060 | .756 | 0 | 7 | 40 |
| 718 | ES | UH13 | PESTICIDES/WATER/GCEC | BBHC | 0.024000 | 0.6000 | .891 | 0 | 7 | 40 |
| 726 | ES | UH13 | PESTICIDES/WATER/GCEC | BENSLF | 0.023000 | 0.5750 | 1.16 | 0 | 7 | 40 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 731 | ES | UH13 | PESTICIDES/WATER/GCEC | CLDAN | 0.265000 | 5.3000 | .962 | 0 | 7 | 40 |
| 716 | ES | UH13 | PESTICIDES/WATER/GCEC | DBHC | 0.029300 | 0.5940 | 1.15 | 0 | 7 | 40 |
| 723 | ES | UH13 | PESTICIDES/WATER/GCEC | DLDRN | 0.024000 | 0.6000 | 1.04 | 0 | 7 | 40 |
| 724 | ES | UH13 | PESTICIDES/WATER/GCEC | ENDRN | 0.023800 | 0.5940 | 1.32 | 0 | 7 | 40 |
| 726 | ES | UH13 | PESTICIDES/WATER/GCEC | ENDRNA | 0.028500 | 0.7130 | 1.00 | 0 | 7 | 40 |
| 729 | ES | UH13 | PESTICIDES/WATER/GCEC | ESFSO4 | 0.078600 | 0.6750 | .961 | 0 | 7 | 40 |
| [illegible] | ES | UH13 | PESTICIDES/WATER/GCEC | HPCL | 0.042300 | 0.6190 | .849 | 0 | 7 | 40 |
| | ES | UH13 | PESTICIDES/WATER/GCEC | HPCLE | 0.024500 | 0.6130 | 1.01 | 0 | 7 | 40 |
| | ES | UH13 | PESTICIDES/WATER/GCEC | ISODR | 0.056200 | 1.1000 | .910 | 0 | 7 | 40 |
| 715 | ES | UH13 | PESTICIDES/WATER/GCEC | LIN | 0.050700 | 0.6190 | .964 | 0 | 7 | 40 |
| 730 | ES | UH13 | PESTICIDES/WATER/GCEC | MEXCLR | 0.057000 | 1.1600 | 1.26 | 0 | 7 | 40 |
| 733 | ES | UH13 | PESTICIDES/WATER/GCEC | PCB016 | 0.486000 | 8.2500 | 1.02 | 0 | 7 | 40 |
| 734 | ES | UH13 | PESTICIDES/WATER/GCEC | PCB260 | 0.636000 | 5.8800 | 1.06 | 0 | 7 | 40 |
| 725 | ES | UH13 | PESTICIDES/WATER/GCEC | PPDDD | 0.023300 | 0.5810 | 1.17 | 0 | 7 | 40 |
| 722 | ES | UH13 | PESTICIDES/WATER/GCEC | PPDDE | 0.027000 | 0.6750 | .999 | 0 | 7 | 40 |
| 727 | ES | UH13 | PESTICIDES/WATER/GCEC | PPDDT | 0.034000 | 0.6630 | .949 | 0 | 7 | 40 |
| 732 | ES | UH13 | PESTICIDES/WATER/GCEC | TXPHEN | 1.350000 | 11.6000 | 1.00 | 0 | 7 | 40 |
| 740 | ES | UH14 | HERBICIDES/WATER/HPLC | 245TP | 0.170000 | 1.3600 | .931 | 0 | 7 | 40 |
| 739 | ES | UH14 | HERBICIDES/WATER/HPLC | 24D | 0.802000 | 2.5200 | .646 | 0 | 7 | 40 |
| 789 | ES | UL04 | ORGANOSULFURS/WATER/GCFP | BTZ | 2.110000 | 42.2000 | .927 | 0 | 7 | 40 |
| 788 | ES | UL04 | ORGANOSULFURS/WATER/GCFP | CPMS | 1.260000 | 25.3000 | .824 | 0 | 7 | 40 |
| 790 | ES | UL04 | ORGANOSULFURS/WATER/GCFP | CPMSO | 4.230000 | 106.0000 | .743 | 0 | 7 | 40 |
| 791 | ES | UL04 | ORGANOSULFURS/WATER/GCFP | CPMSO2 | 4.720000 | 106.0000 | .866 | 0 | 7 | 40 |
| 787 | ES | UL04 | ORGANOSULFURS/WATER/GCFP | DITH | 1.110000 | 22.2000 | .831 | 0 | 7 | 40 |
| 785 | ES | UL04 | ORGANOSULFURS/WATER/GCFP | DMDS | 1.140000 | 22.8000 | .801 | 0 | 7 | 40 |
| 786 | ES | UL04 | ORGANOSULFURS/WATER/GCFP | OXAT | 1.980000 | 39.5000 | .829 | 0 | 7 | 40 |
| 300 | ES | UM04 | VOLATILES/WATER/GCMS | 111TCE | 1.000000 | 160.0000 | .987 | 14 | 0 | 0 |
| 301 | ES | UM04 | VOLATILES/WATER/GCMS | 112TCE | 1.000000 | 160.0000 | 1.06 | 14 | 0 | 0 |
| 302 | ES | UM04 | VOLATILES/WATER/GCMS | 11DCLE | 2.000000 | 80.0000 | 1.00 | 14 | 0 | 0 |
| 303 | ES | UM04 | VOLATILES/WATER/GCMS | 12DCD4 | 2.900000 | 160.0000 | 1.02 | 14 | 0 | 0 |
| 304 | ES | UM04 | VOLATILES/WATER/GCMS | 12DCE | 1.200000 | 160.0000 | .950 | 14 | 0 | 0 |
| 305 | ES | UM04 | VOLATILES/WATER/GCMS | 12DCLE | 1.000000 | 160.0000 | .979 | 14 | 0 | 0 |
| 306 | ES | UM04 | VOLATILES/WATER/GCMS | 13DMB | 1.000000 | 160.0000 | .983 | 14 | 0 | 0 |
| 307 | ES | UM04 | VOLATILES/WATER/GCMS | BCHPD | 1.000000 | 160.0000 | .989 | 14 | 0 | 0 |
| 308 | ES | UM04 | VOLATILES/WATER/GCMS | C6H6 | 1.100000 | 160.0000 | 1.03 | 14 | 0 | 0 |
| 309 | ES | UM04 | VOLATILES/WATER/GCMS | CCL4 | 1.500000 | 160.0000 | .980 | 14 | 0 | 0 |
| 310 | ES | UM04 | VOLATILES/WATER/GCMS | CD2CL2 | 2.000000 | 160.0000 | .952 | 14 | 0 | 0 |
| 311 | ES | UM04 | VOLATILES/WATER/GCMS | CH2CL2 | 4.800000 | 160.0000 | .888 | 14 | 0 | 0 |
| 312 | ES | UM04 | VOLATILES/WATER/GCMS | CHCL3 | 1.000000 | 160.0000 | .961 | 14 | 0 | 0 |
| 313 | ES | UM04 | VOLATILES/WATER/GCMS | CLC6H5 | 2.100000 | 160.0000 | 1.02 | 14 | 0 | 0 |
| [illegible] | ES | UM04 | VOLATILES/WATER/GCMS | DBCP | 4.000000 | 80.0000 | 1.05 | 14 | 0 | 0 |
| | ES | UM04 | VOLATILES/WATER/GCMS | DCPD | 1.100000 | 170.0000 | .985 | 14 | 0 | 0 |
| | ES | UM04 | VOLATILES/WATER/GCMS | DMDS | 2.500000 | 160.0000 | 1.03 | 14 | 0 | 0 |
| 317 | ES | UM04 | VOLATILES/WATER/GCMS | ETBD10 | 1.000000 | 160.0000 | .996 | 14 | 0 | 0 |
| 318 | ES | UM04 | VOLATILES/WATER/GCMS | ETC6H5 | 1.000000 | 160.0000 | .994 | 14 | 0 | 0 |
| 319 | ES | UM04 | VOLATILES/WATER/GCMS | MEC6H5 | 1.000000 | 160.0000 | .997 | 14 | 0 | 0 |
| 320 | ES | UM04 | VOLATILES/WATER/GCMS | MIBK | 2.000000 | 80.0000 | 1.07 | 14 | 0 | 0 |
| 321 | ES | UM04 | VOLATILES/WATER/GCMS | TCLEE | 1.000000 | 160.0000 | 1.02 | 14 | 0 | 0 |
| 322 | ES | UM04 | VOLATILES/WATER/GCMS | TRCLE | 1.000000 | 160.0000 | 1.01 | 14 | 0 | 0 |
| 323 | ES | UM04 | VOLATILES/WATER/GCMS | XYLEN | 2.000000 | 320.0000 | 1.02 | 14 | 0 | 0 |
| 324 | ES | UM08 | ORGANICS/WATER/GCMS | 245TCP | 5.200000 | 200.0000 | 1.05 | 0 | 7 | 40 |
| 326 | ES | UM08 | ORGANICS/WATER/GCMS | 246TBP | 13.000000 | 200.0000 | 1.25 | 0 | 7 | 40 |
| 325 | ES | UM08 | ORGANICS/WATER/GCMS | 246TCP | 4.200000 | 100.0000 | 1.02 | 0 | 7 | 40 |
| 327 | ES | UM08 | ORGANICS/WATER/GCMS | 24DCLP | 1.000000 | 200.0000 | .930 | 0 | 7 | 40 |
| 328 | ES | UM08 | ORGANICS/WATER/GCMS | 24DMPN | 2.100000 | 100.0000 | .937 | 0 | 7 | 40 |
| 329 | ES | UM08 | ORGANICS/WATER/GCMS | 24DNP | 21.000000 | 100.0000 | 1.55 | 0 | 7 | 40 |
| 330 | ES | UM08 | ORGANICS/WATER/GCMS | 2CLP | 1.100000 | 200.0000 | .967 | 0 | 7 | 40 |
| 331 | ES | UM08 | ORGANICS/WATER/GCMS | 2FBP | 12.000000 | 100.0000 | .891 | 0 | 7 | 40 |
| 332 | ES | UM08 | ORGANICS/WATER/GCMS | 2FP | 17.000000 | 200.0000 | .657 | 0 | 7 | 40 |
| 333 | ES | UM08 | ORGANICS/WATER/GCMS | 2MP | 0.500000 | 200.0000 | .967 | 0 | 7 | 40 |
| 334 | ES | UM08 | ORGANICS/WATER/GCMS | 2NP | 3.700000 | 100.0000 | .986 | 0 | 7 | 40 |
| 335 | ES | UM08 | ORGANICS/WATER/GCMS | 46DN2C | 17.000000 | 100.0000 | 1.22 | 0 | 7 | 40 |
| 336 | ES | UM08 | ORGANICS/WATER/GCMS | 4CL3C | 0.840000 | 200.0000 | .989 | 0 | 7 | 40 |
| 337 | ES | UM08 | ORGANICS/WATER/GCMS | 4MP | 0.520000 | 200.0000 | .847 | 0 | 7 | 40 |
| 338 | ES | UM08 | ORGANICS/WATER/GCMS | 4NP | 12.000000 | 100.0000 | .662 | 0 | 7 | 40 |
| 340 | ES | UM08 | ORGANICS/WATER/GCMS | BENZOA | 8.000000 | 100.0000 | .704 | 0 | 7 | 40 |
| 339 | ES | UM08 | ORGANICS/WATER/GCMS | BZALC | 0.720000 | 200.0000 | .969 | 0 | 7 | 40 |
| 341 | ES | UM08 | ORGANICS/WATER/GCMS | NBD5 | 11.000000 | 100.0000 | .845 | 0 | 7 | 40 |
| 342 | ES | UM08 | ORGANICS/WATER/GCMS | PCP | 21.000000 | 100.0000 | 1.39 | 0 | 7 | 40 |
| 343 | ES | UM08 | ORGANICS/WATER/GCMS | PHEND6 | 36.000000 | 200.0000 | .501 | 0 | 7 | 40 |
| 344 | ES | UM08 | ORGANICS/WATER/GCMS | PHENOL | 13.000000 | 200.0000 | .529 | 0 | 7 | 40 |
| 345 | ES | UM08 | ORGANICS/WATER/GCMS | TRPD14 | 14.000000 | 100.0000 | .878 | 0 | 7 | 40 |
| 478 | ES | UM18 | ORGANICS/WATER/GCMS | 124TCB | 1.800000 | 50.0000 | .824 | 0 | 7 | 40 |
| 479 | ES | UM18 | ORGANICS/WATER/GCMS | 12DCLB | 1.700000 | 50.0000 | .856 | 0 | 7 | 40 |
| 480 | ES | UM18 | ORGANICS/WATER/GCMS | 13DCLB | 1.700000 | 200.0000 | .790 | 0 | 7 | 40 |
| | ES | UM18 | ORGANICS/WATER/GCMS | 14DCLB | 1.700000 | 200.0000 | .786 | 0 | 7 | 40 |
| | ES | UM18 | ORGANICS/WATER/GCMS | 245TCP | 5.200000 | 200.0000 | 1.06 | 0 | 7 | 40 |
| | ES | UM18 | ORGANICS/WATER/GCMS | 246TBP | 13.000000 | 200.0000 | 1.26 | 0 | 7 | 40 |
| 583 | ES | UM18 | ORGANICS/WATER/GCMS | 246TCP | 4.200000 | 100.0000 | 1.02 | 0 | 7 | 40 |
| 484 | ES | UM18 | ORGANICS/WATER/GCMS | 24DCLP | 2.900000 | 200.0000 | .930 | 0 | 7 | 40 |
| 485 | ES | UM18 | ORGANICS/WATER/GCMS | 24DMPN | 5.800000 | 100.0000 | .938 | 0 | 7 | 40 |
| 486 | ES | UM18 | ORGANICS/WATER/GCMS | 24DNP | 21.000000 | 100.0000 | 1.37 | 0 | 7 | 40 |
| 487 | ES | UM18 | ORGANICS/WATER/GCMS | 24DNT | 4.500000 | 200.0000 | .954 | 0 | 7 | 40 |
| 584 | ES | UM18 | ORGANICS/WATER/GCMS | 26DNT | 0.790000 | 200.0000 | 1.09 | 0 | 7 | 40 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 488 | ES | UM18 | ORGANICS/WATER/GCMS | 2CLP | 0.990000 | 200.0000 | .967 | 0 | 7 | 40 |
| 489 | ES | UM18 | ORGANICS/WATER/GCMS | 2CNAP | 0.500000 | 200.0000 | .880 | 0 | 7 | 40 |
| 490 | ES | UM18 | ORGANICS/WATER/GCMS | 2FBP | 12.000000 | 100.0000 | .891 | 0 | 7 | 40 |
| 491 | ES | UM18 | ORGANICS/WATER/GCMS | 2FP | 17.000000 | 200.0000 | .657 | 0 | 7 | 40 |
| 492 | ES | UM18 | ORGANICS/WATER/GCMS | 2MNAP | 1.700000 | 50.0000 | .919 | 0 | 7 | 40 |
| 493 | ES | UM18 | ORGANICS/WATER/GCMS | 2MP | 3.900000 | 200.0000 | .967 | 0 | 7 | 40 |
| 494 | ES | UM18 | ORGANICS/WATER/GCMS | 2NANIL | 4.300000 | 100.0000 | .958 | 0 | 7 | 40 |
| 495 | ES | UM18 | ORGANICS/WATER/GCMS | 2NP | 3.700000 | 100.0000 | .986 | 0 | 7 | 4 |
| 496 | ES | UM18 | ORGANICS/WATER/GCMS | 33DCBD | 12.000000 | 100.0000 | 1.53 | 0 | 7 | 4 |
| 497 | ES | UM18 | ORGANICS/WATER/GCMS | 3NANIL | 4.900000 | 100.0000 | .965 | 0 | 7 | 40 |
| 498 | ES | UM18 | ORGANICS/WATER/GCMS | 46DN2C | 17.000000 | 100.0000 | 1.22 | 0 | 7 | 40 |
| 499 | ES | UM18 | ORGANICS/WATER/GCMS | 4BRPPE | 4.200000 | 100.0000 | .902 | 0 | 7 | 40 |
| 585 | ES | UM18 | ORGANICS/WATER/GCMS | 4CANIL | 7.300000 | 100.0000 | .872 | 0 | 7 | 40 |
| 500 | ES | UM18 | ORGANICS/WATER/GCMS | 4CL3C | 4.000000 | 200.0000 | .989 | 0 | 7 | 40 |
| 501 | ES | UM18 | ORGANICS/WATER/GCMS | 4CLPPE | 5.100000 | 100.0000 | .856 | 0 | 7 | 40 |
| 502 | ES | UM18 | ORGANICS/WATER/GCMS | 4MP | 0.520000 | 200.0000 | .848 | 0 | 7 | 40 |
| 503 | ES | UM18 | ORGANICS/WATER/GCMS | 4NANIL | 5.200000 | 100.0000 | 1.01 | 0 | 7 | 40 |
| 504 | ES | UM18 | ORGANICS/WATER/GCMS | 4NP | 12.000000 | 100.0000 | .662 | 0 | 7 | 40 |
| 505 | ES | UM18 | ORGANICS/WATER/GCMS | ANAPNE | 1.700000 | 50.0000 | .946 | 0 | 7 | 40 |
| 506 | ES | UM18 | ORGANICS/WATER/GCMS | ANAPYL | 0.500000 | 50.0000 | .966 | 0 | 7 | 40 |
| 507 | ES | UM18 | ORGANICS/WATER/GCMS | ANTRC | 0.500000 | 100.0000 | .974 | 0 | 7 | 40 |
| 508 | ES | UM18 | ORGANICS/WATER/GCMS | B2CEXM | 1.500000 | 50.0000 | .928 | 0 | 7 | 40 |
| 509 | ES | UM18 | ORGANICS/WATER/GCMS | B2CIPE | 5.300000 | 200.0000 | .834 | 0 | 7 | 40 |
| 510 | ES | UM18 | ORGANICS/WATER/GCMS | B2CLEE | 1.900000 | 50.0000 | .943 | 0 | 7 | 40 |
| 511 | ES | UM18 | ORGANICS/WATER/GCMS | B2EHP | 4.800000 | 100.0000 | 1.10 | 0 | 7 | 40 |
| 512 | ES | UM18 | ORGANICS/WATER/GCMS | BAANTR | 1.600000 | 100.0000 | .996 | 0 | 7 | 40 |
| 513 | ES | UM18 | ORGANICS/WATER/GCMS | BAPYR | 4.700000 | 100.0000 | 1.12 | 0 | 7 | 40 |
| 514 | ES | UM18 | ORGANICS/WATER/GCMS | BBFANT | 5.400000 | 50.0000 | 1.05 | 0 | 7 | 40 |
| 515 | ES | UM18 | ORGANICS/WATER/GCMS | BBZP | 3.400000 | 100.0000 | 1.06 | 0 | 7 | 40 |
| 516 | ES | UM18 | ORGANICS/WATER/GCMS | BENZOA | 13.000000 | 100.0000 | .646 | 0 | 7 | 40 |
| 517 | ES | UM18 | ORGANICS/WATER/GCMS | BGHIPY | 6.100000 | 50.0000 | 1.30 | 0 | 7 | 40 |
| 518 | ES | UM18 | ORGANICS/WATER/GCMS | BKFANT | 0.870000 | 100.0000 | 1.02 | 0 | 7 | 40 |
| 519 | ES | UM18 | ORGANICS/WATER/GCMS | BZALC | 0.720000 | 100.0000 | .861 | 0 | 7 | 40 |
| 520 | ES | UM18 | ORGANICS/WATER/GCMS | CHRY | 2.400000 | 100.0000 | .967 | 0 | 7 | 40 |
| 521 | ES | UM18 | ORGANICS/WATER/GCMS | CL6BZ | 1.600000 | 100.0000 | .949 | 0 | 7 | 40 |
| 522 | ES | UM18 | ORGANICS/WATER/GCMS | CL6CP | 8.600000 | 100.0000 | .708 | 0 | 7 | 40 |
| 523 | ES | UM18 | ORGANICS/WATER/GCMS | CL6ET | 1.500000 | 50.0000 | .818 | 0 | 7 | 40 |
| 524 | ES | UM18 | ORGANICS/WATER/GCMS | DBAHA | 6.500000 | 50.0000 | 1.16 | 0 | 7 | 40 |
| 525 | ES | UM18 | ORGANICS/WATER/GCMS | DBZFUR | 1.700000 | 50.0000 | .941 | 0 | 7 | 40 |
| 526 | ES | UM18 | ORGANICS/WATER/GCMS | DEP | 2.000000 | 200.0000 | .863 | 0 | 7 | 40 |
| 527 | ES | UM18 | ORGANICS/WATER/GCMS | DMP | 1.500000 | 100.0000 | .807 | 0 | 7 | 40 |
| 528 | ES | UM18 | ORGANICS/WATER/GCMS | DNBP | 3.700000 | 200.0000 | 1.10 | 0 | 7 | 4 |
| 586 | ES | UM18 | ORGANICS/WATER/GCMS | DNOP | 15.000000 | 100.0000 | 1.28 | 0 | 7 | 4 |
| 529 | ES | UM18 | ORGANICS/WATER/GCMS | FANT | 3.300000 | 100.0000 | .996 | 0 | 7 | 40 |
| 530 | ES | UM18 | ORGANICS/WATER/GCMS | FLRENE | 3.700000 | 50.0000 | .960 | 0 | 7 | 40 |
| 531 | ES | UM18 | ORGANICS/WATER/GCMS | HCBD | 3.400000 | 100.0000 | .731 | 0 | 7 | 40 |
| 532 | ES | UM18 | ORGANICS/WATER/GCMS | ICDPYR | 8.600000 | 100.0000 | 1.17 | 0 | 7 | 40 |
| 533 | ES | UM18 | ORGANICS/WATER/GCMS | ISOPHR | 4.800000 | 50.0000 | .971 | 0 | 7 | 40 |
| 534 | ES | UM18 | ORGANICS/WATER/GCMS | NAP | 0.500000 | 20.0000 | 1.16 | 0 | 7 | 40 |
| 535 | ES | UM18 | ORGANICS/WATER/GCMS | NB | 0.500000 | 50.0000 | .887 | 0 | 7 | 40 |
| 536 | ES | UM18 | ORGANICS/WATER/GCMS | NBD5 | 11.000000 | 100.0000 | .845 | 0 | 7 | 40 |
| 537 | ES | UM18 | ORGANICS/WATER/GCMS | NNDNPA | 4.400000 | 50.0000 | .987 | 0 | 7 | 40 |
| 538 | ES | UM18 | ORGANICS/WATER/GCMS | NNDPA | 3.000000 | 200.0000 | .956 | 0 | 7 | 40 |
| 539 | ES | UM18 | ORGANICS/WATER/GCMS | PCP | 18.000000 | 100.0000 | 1.26 | 0 | 7 | 40 |
| 540 | ES | UM18 | ORGANICS/WATER/GCMS | PHANTR | 0.500000 | 100.0000 | 1.00 | 0 | 7 | 40 |
| 587 | ES | UM18 | ORGANICS/WATER/GCMS | PHEND6 | 36.000000 | 200.0000 | .50 | 0 | 7 | 40 |
| 541 | ES | UM18 | ORGANICS/WATER/GCMS | PHENOL | 9.200000 | 200.0000 | .542 | 0 | 7 | 40 |
| 542 | ES | UM18 | ORGANICS/WATER/GCMS | PYR | 2.800000 | 100.0000 | .995 | 0 | 7 | 40 |
| 543 | ES | UM18 | ORGANICS/WATER/GCMS | TRPD14 | 14.000000 | 100.0000 | .878 | 0 | 7 | 40 |
| 544 | ES | UM20 | VOLATILES/WATER/GCMS | 111TCE | 0.500000 | 200.0000 | 1.01 | 14 | 0 | 0 |
| 545 | ES | UM20 | VOLATILES/WATER/GCMS | 112TCE | 1.200000 | 200.0000 | .943 | 14 | 0 | 0 |
| 546 | ES | UM20 | VOLATILES/WATER/GCMS | 11DCE | 0.500000 | 200.0000 | 1.06 | 14 | 0 | 0 |
| 547 | ES | UM20 | VOLATILES/WATER/GCMS | 11DCLE | 0.680000 | 200.0000 | .983 | 14 | 0 | 0 |
| 548 | ES | UM20 | VOLATILES/WATER/GCMS | 12DCD4 | 23.000000 | 200.0000 | .881 | 14 | 0 | 0 |
| 549 | ES | UM20 | VOLATILES/WATER/GCMS | 12DCE | 0.500000 | 200.0000 | 1.03 | 14 | 0 | 0 |
| 550 | ES | UM20 | VOLATILES/WATER/GCMS | 12DCLE | 0.500000 | 50.0000 | .995 | 14 | 0 | 0 |
| 551 | ES | UM20 | VOLATILES/WATER/GCMS | 12DCLP | 0.500000 | 200.0000 | 1.02 | 14 | 0 | 0 |
| 552 | ES | UM20 | VOLATILES/WATER/GCMS | 2CLEVE | 0.710000 | 200.0000 | 1.01 | 14 | 0 | 0 |
| 553 | ES | UM20 | VOLATILES/WATER/GCMS | 4BFB | 6.500000 | 200.0000 | 1.11 | 14 | 0 | 0 |
| 554 | ES | UM20 | VOLATILES/WATER/GCMS | ACET | 13.000000 | 50.0000 | .907 | 14 | 0 | 0 |
| 555 | ES | UM20 | VOLATILES/WATER/GCMS | BRDCLM | 0.590000 | 200.0000 | 1.02 | 14 | 0 | 0 |
| 556 | ES | UM20 | VOLATILES/WATER/GCMS | C13DCP | 0.580000 | 230.0000 | 1.02 | 14 | 0 | 0 |
| 557 | ES | UM20 | VOLATILES/WATER/GCMS | C2AVE | 8.300000 | 50.0000 | .984 | 14 | 0 | 0 |
| 558 | ES | UM20 | VOLATILES/WATER/GCMS | C2H3CL | 2.600000 | 200.0000 | .964 | 14 | 0 | 0 |
| 559 | ES | UM20 | VOLATILES/WATER/GCMS | C2H5CL | 1.900000 | 200.0000 | .980 | 14 | 0 | 0 |
| 560 | ES | UM20 | VOLATILES/WATER/GCMS | C6H6 | 0.500000 | 200.0000 | 1.01 | 14 | 0 | |
| 561 | ES | UM20 | VOLATILES/WATER/GCMS | CCL3F | 1.400000 | 50.0000 | .998 | 14 | 0 | |
| 562 | ES | UM20 | VOLATILES/WATER/GCMS | CCL4 | 0.580000 | 200.0000 | 1.05 | 14 | 0 | |
| 563 | ES | UM20 | VOLATILES/WATER/GCMS | CH2CL2 | 2.300000 | 100.0000 | 1.06 | 14 | 0 | [illegible] |
| 564 | ES | UM20 | VOLATILES/WATER/GCMS | CH3BR | 5.800000 | 100.0000 | 1.01 | 14 | 0 | 0 |
| 565 | ES | UM20 | VOLATILES/WATER/GCMS | CH3CL | 3.200000 | 200.0000 | .952 | 14 | 0 | 0 |
| 566 | ES | UM20 | VOLATILES/WATER/GCMS | CHBR3 | 2.600000 | 200.0000 | 1.05 | 14 | 0 | 0 |
| 567 | ES | UM20 | VOLATILES/WATER/GCMS | CHCL3 | 0.500000 | 200.0000 | .975 | 14 | 0 | 0 |
| 568 | ES | UM20 | VOLATILES/WATER/GCMS | CLC6H5 | 0.500000 | 200.0000 | 1.04 | 14 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 569 | ES | UM20 | VOLATILES/WATER/GCMS | CS2 | 0.500000 | 200.0000 | .882 | 14 | 0 | 0 |
| 570 | ES | UM20 | VOLATILES/WATER/GCMS | DBRCLM | 0.670000 | 100.0000 | .981 | 14 | 0 | 0 |
| 571 | ES | UM20 | VOLATILES/WATER/GCMS | ETC6H5 | 0.500000 | 200.0000 | 1.05 | 14 | 0 | 0 |
| 572 | ES | UM20 | VOLATILES/WATER/GCMS | MEC6D8 | 0.500000 | 200.0000 | 1.06 | 14 | 0 | 0 |
| 573 | ES | UM20 | VOLATILES/WATER/GCMS | MEC6H5 | 0.500000 | 200.0000 | 1.02 | 14 | 0 | 0 |
| 574 | ES | UM20 | VOLATILES/WATER/GCMS | MEK | 6.400000 | 200.0000 | .992 | 14 | 0 | 0 |
| | ES | UM20 | VOLATILES/WATER/GCMS | MIBK | 3.000000 | 200.0000 | .918 | 14 | 0 | 0 |
| | ES | UM20 | VOLATILES/WATER/GCMS | MNBK | 3.600000 | 200.0000 | .917 | 14 | 0 | 0 |
| | ES | UM20 | VOLATILES/WATER/GCMS | STYR | 0.500000 | 200.0000 | 1.10 | 14 | 0 | 0 |
| 578 | ES | UM20 | VOLATILES/WATER/GCMS | T13DCP | 0.700000 | 200.0000 | .964 | 14 | 0 | 0 |
| 579 | ES | UM20 | VOLATILES/WATER/GCMS | TCLEA | 0.510000 | 200.0000 | 1.03 | 14 | 0 | 0 |
| 580 | ES | UM20 | VOLATILES/WATER/GCMS | TCLEE | 1.600000 | 200.0000 | .984 | 14 | 0 | 0 |
| 581 | ES | UM20 | VOLATILES/WATER/GCMS | TRCLE | 0.500000 | 200.0000 | 1.05 | 14 | 0 | 0 |
| 582 | ES | UM20 | VOLATILES/WATER/GCMS | XYLEN | 0.840000 | 200.0000 | 1.06 | 14 | 0 | 0 |
| 921 | ES | UN07 | NP-PESTICIDES/WATER/GCFP | ATZ | 0.512000 | 5.0000 | 1.04 | 0 | 7 | 40 |
| 922 | ES | UN07 | NP-PESTICIDES/WATER/GCFP | DDVP | 0.250000 | 5.0000 | .884 | 0 | 7 | 40 |
| 923 | ES | UN07 | NP-PESTICIDES/WATER/GCFP | MLTHN | 0.250000 | 5.0000 | .999 | 0 | 7 | 40 |
| 924 | ES | UN07 | NP-PESTICIDES/WATER/GCFP | PRTHN | 0.250000 | 5.0000 | .983 | 0 | 7 | 40 |
| 925 | ES | UN07 | NP-PESTICIDES/WATER/GCFP | SUPONA | 0.235000 | 4.7000 | 1.00 | 0 | 7 | 40 |
| 873 | ES | UN08 | NITROSAMINES/WATER/GC-NPD | 24DNT | 0.341000 | 5.0000 | .979 | 0 | 7 | 40 |
| 872 | ES | UN08 | NITROSAMINES/WATER/GC-NPD | 26DNT | 0.250000 | 5.0000 | .964 | 0 | 7 | 40 |
| 875 | ES | UN08 | NITROSAMINES/WATER/GC-NPD | NB | 0.285000 | 5.0000 | 1.00 | 0 | 7 | 40 |
| 874 | ES | UN08 | NITROSAMINES/WATER/GC-NPD | NNDNPA | 0.294000 | 5.0000 | 1.03 | 0 | 7 | 40 |
| 871 | ES | UN08 | NITROSAMINES/WATER/GC-NPD | NNDPA | 0.250000 | 5.0000 | .968 | 0 | 7 | 40 |
| 836 | ES | U002 | VOLATILES/WATER/GCDUAL | 111TCE | 2.900000 | 50.0000 | 1.08 | 14 | 0 | 0 |
| 837 | ES | U002 | VOLATILES/WATER/GCDUAL | 112TCE | 0.332000 | 49.0000 | 1.10 | 14 | 0 | 0 |
| 838 | ES | U002 | VOLATILES/WATER/GCDUAL | 11DCE | 0.393000 | 51.0000 | 1.06 | 14 | 0 | 0 |
| 839 | ES | U002 | VOLATILES/WATER/GCDUAL | 11DCLE | 0.334000 | 49.5000 | 1.03 | 14 | 0 | 0 |
| 842 | ES | U002 | VOLATILES/WATER/GCDUAL | 12DCLE | 2.950000 | 49.0000 | 1.08 | 14 | 0 | 0 |
| 843 | ES | U002 | VOLATILES/WATER/GCDUAL | 12DCLP | 3.160000 | 49.0000 | 1.09 | 14 | 0 | 0 |
| 844 | ES | U002 | VOLATILES/WATER/GCDUAL | 13DCLB | 1.340000 | 50.0000 | .921 | 14 | 0 | 0 |
| 845 | ES | U002 | VOLATILES/WATER/GCDUAL | 13DMB | 1.560000 | 49.5000 | 1.00 | 14 | 0 | 0 |
| 846 | ES | U002 | VOLATILES/WATER/GCDUAL | 2CLEVE | 22.100000 | 49.5000 | 1.11 | 14 | 0 | 0 |
| 847 | ES | U002 | VOLATILES/WATER/GCDUAL | BRDCLM | 3.060000 | 50.5000 | 1.11 | 14 | 0 | 0 |
| 848 | ES | U002 | VOLATILES/WATER/GCDUAL | C13DCP | 3.230000 | 48.5000 | 1.08 | 14 | 0 | 0 |
| 849 | ES | U002 | VOLATILES/WATER/GCDUAL | C2H3CL | 2.070000 | 50.0000 | 1.16 | 14 | 0 | 0 |
| 850 | ES | U002 | VOLATILES/WATER/GCDUAL | C2H5CL | 1.600000 | 50.0000 | 1.24 | 14 | 0 | 0 |
| 851 | ES | U002 | VOLATILES/WATER/GCDUAL | C6H6 | 0.651000 | 49.0000 | 1.07 | 14 | 0 | 0 |
| 866 | ES | U002 | VOLATILES/WATER/GCDUAL | CCL2F2 | 2.040000 | 50.0000 | 1.25 | 14 | 0 | 0 |
| 869 | ES | U002 | VOLATILES/WATER/GCDUAL | CCL3F | 0.503000 | 51.5000 | 1.06 | 14 | 0 | 0 |
| | ES | U002 | VOLATILES/WATER/GCDUAL | CCL4 | 2.810000 | 49.0000 | 1.03 | 14 | 0 | 0 |
| | ES | U002 | VOLATILES/WATER/GCDUAL | CH2CL2 | 3.100000 | 49.0000 | 1.05 | 14 | 0 | 0 |
| | ES | U002 | VOLATILES/WATER/GCDUAL | CH3BR | 2.680000 | 50.0000 | 1.20 | 14 | 0 | 0 |
| 854 | ES | U002 | VOLATILES/WATER/GCDUAL | CH3CL | 1.980000 | 50.0000 | 1.04 | 14 | 0 | 0 |
| 855 | ES | U002 | VOLATILES/WATER/GCDUAL | CHBR3 | 4.030000 | 52.0000 | 1.06 | 14 | 0 | 0 |
| 856 | ES | U002 | VOLATILES/WATER/GCDUAL | CHCL3 | 1.260000 | 50.0000 | 1.05 | 14 | 0 | 0 |
| 841 | ES | U002 | VOLATILES/WATER/GCDUAL | CL2BZ | 6.220000 | 111.0000 | .994 | 14 | 0 | 0 |
| 857 | ES | U002 | VOLATILES/WATER/GCDUAL | CLC6H5 | 0.582000 | 50.5000 | .988 | 14 | 0 | 0 |
| 858 | ES | U002 | VOLATILES/WATER/GCDUAL | DBRCLM | 0.352000 | 51.5000 | 1.10 | 14 | 0 | 0 |
| 859 | ES | U002 | VOLATILES/WATER/GCDUAL | ETC6H5 | 0.857000 | 49.5000 | .999 | 14 | 0 | 0 |
| 860 | ES | U002 | VOLATILES/WATER/GCDUAL | MEC6H5 | 0.716000 | 49.5000 | 1.04 | 14 | 0 | 0 |
| 840 | ES | U002 | VOLATILES/WATER/GCDUAL | T12DCE | 0.427000 | 49.0000 | 1.04 | 14 | 0 | 0 |
| 861 | ES | U002 | VOLATILES/WATER/GCDUAL | T13DCP | 0.326000 | 49.5000 | 1.10 | 14 | 0 | 0 |
| 862 | ES | U002 | VOLATILES/WATER/GCDUAL | TCLEA | 1.090000 | 52.0000 | .953 | 14 | 0 | 0 |
| 863 | ES | U002 | VOLATILES/WATER/GCDUAL | TCLEE | 0.677000 | 51.0000 | .996 | 14 | 0 | 0 |
| 864 | ES | U002 | VOLATILES/WATER/GCDUAL | TRCLE | 3.590000 | 50.0000 | 1.05 | 14 | 0 | 0 |
| 870 | ES | U002 | VOLATILES/WATER/GCDUAL | XYLEN | 1.730000 | 102.0000 | .995 | 14 | 0 | 0 |
| 945 | ES | UT02 | ORGANICS/WATER/IC | FC2A | 100.000000 | 9000.0000 | 1.01 | 40 | 0 | 0 |
| 943 | ES | UT02 | ORGANICS/WATER/IC | IMPA | 100.000000 | 9000.0000 | .991 | 40 | 0 | 0 |
| 944 | ES | UT02 | ORGANICS/WATER/IC | MPA | 128.000000 | 9000.0000 | 1.02 | 40 | 0 | 0 |
| 346 | ES | UU9 | ORGANOSULFURS/SOIL/GCFP | BTZ | 1.080000 | 13.2000 | .788 | 0 | 7 | 40 |
| 347 | ES | UU9 | ORGANOSULFURS/SOIL/GCFP | CPMS | 1.080000 | 21.6000 | .999 | 0 | 7 | 40 |
| 348 | ES | UU9 | ORGANOSULFURS/SOIL/GCFP | CPMSO | 2.250000 | 45.0000 | 1.02 | 0 | 7 | 40 |
| 349 | ES | UU9 | ORGANOSULFURS/SOIL/GCFP | CPMSO2 | 2.370000 | 47.4000 | .790 | 0 | 7 | 40 |
| 350 | ES | UU9 | ORGANOSULFURS/SOIL/GCFP | DITH | 0.571000 | 11.4000 | .916 | 0 | 7 | 40 |
| 351 | ES | UU9 | ORGANOSULFURS/SOIL/GCFP | DMDS | 0.692000 | 13.8000 | .946 | 0 | 7 | 40 |
| 352 | ES | UU9 | ORGANOSULFURS/SOIL/GCFP | OXAT | 0.856000 | 17.1000 | .930 | 0 | 7 | 40 |
| 353 | ES | UW04 | HERBICIDES/WATER/HPLC | BRMCIL | 3.830000 | 61.5000 | .961 | 40 | 0 | 0 |
| 467 | ES | UW14 | EXPLOSIVES/WATER/HPLC | 135TNB | 0.626000 | 42.1000 | .817 | 0 | 56 | 40 |
| 468 | ES | UW14 | EXPLOSIVES/WATER/HPLC | 13DNB | 0.519000 | 40.1000 | .832 | 0 | 56 | 40 |
| 471 | ES | UW14 | EXPLOSIVES/WATER/HPLC | 246TNT | 0.508000 | 40.2000 | .855 | 0 | 56 | 40 |
| 473 | ES | UW14 | EXPLOSIVES/WATER/HPLC | 24DNT | 0.612000 | 40.2000 | .835 | 0 | 56 | 40 |
| 472 | ES | UW14 | EXPLOSIVES/WATER/HPLC | 26DNT | 1.150000 | 52.4000 | .767 | 0 | 56 | 40 |
| 465 | ES | UW14 | EXPLOSIVES/WATER/HPLC | HMX | 1.650000 | 28.9000 | .932 | 0 | 56 | 40 |
| 469 | ES | UW14 | EXPLOSIVES/WATER/HPLC | NB | 1.070000 | 54.9000 | .795 | 0 | 56 | 40 |
| | ES | UW14 | EXPLOSIVES/WATER/HPLC | RDX | 2.110000 | 43.9000 | .851 | 0 | 56 | 40 |
| | ES | UW14 | EXPLOSIVES/WATER/HPLC | TETRYL | 0.556000 | 44.5000 | .749 | 0 | 56 | 40 |
| | ES | UW17 | EXPLOSIVES/WATER/HPLC | NQ | 30.900000 | 620.0000 | .956 | 0 | 56 | 40 |
| 760 | ES | UW18 | PHENOLS/WATER/HPLC | 246TCP | 1.900000 | 111.0000 | .743 | 0 | 7 | 40 |
| 754 | ES | UW18 | PHENOLS/WATER/HPLC | 24DCLP | 0.617000 | 115.0000 | .739 | 0 | 7 | 40 |
| 753 | ES | UW18 | PHENOLS/WATER/HPLC | 2CLP | 1.690000 | 88.0000 | .623 | 0 | 7 | 40 |
| 756 | ES | UW18 | PHENOLS/WATER/HPLC | 2NP | 0.363000 | 27.2000 | .684 | 0 | 7 | 40 |
| 755 | ES | UW18 | PHENOLS/WATER/HPLC | 46DN2C | 0.295000 | 25.8000 | .700 | 0 | 7 | 40 |
| 752 | ES | UW18 | PHENOLS/WATER/HPLC | 4CL3C | 5.560000 | 69.7000 | .693 | 0 | 7 | 40 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 759 | ES | UW18 | PHENOLS/WATER/HPLC | 4NP | 0.273000 | 31.9000 | .762 | 0 | 7 | 40 |
| 757 | ES | UW18 | PHENOLS/WATER/HPLC | PCP | 1.490000 | 16.4000 | .891 | 0 | 7 | 40 |
| 756 | ES | UW18 | PHENOLS/WATER/HPLC | PHENOL | 7.990000 | 103.0000 | .681 | 0 | 7 | 40 |
| 737 | ES | UW19 | EXPLOSIVES/WATER/HPLC | NG | 10.000000 | 200.0000 | 1.04 | 0 | 56 | 40 |
| 736 | ES | UW19 | EXPLOSIVES/WATER/HPLC | PETN | 20.000000 | 400.0000 | 1.05 | 0 | 56 | 40 |
| 927 | ES | UW22 | ORGANOSULFURS/WATER/HPLC | TDGCL | 48.800000 | 4880.0000 | .687 | 0 | 7 | 40 |
| 926 | ES | UW22 | ORGANOSULFURS/WATER/HPLC | TDGCLA | 52.700000 | 1780.0000 | .930 | 0 | 7 | 40 |
| 955 | ES | UW32 | EXPLOSIVES/WATER/HPLC-U | 135TNB | 0.449000 | 59.2000 | .993 | 0 | 56 | 4 |
| 948 | ES | UW32 | EXPLOSIVES/WATER/HPLC-U | 13DNB | 0.611000 | 55.0000 | 0.95 | 0 | 56 | 4 |
| 956 | ES | UW32 | EXPLOSIVES/WATER/HPLC-U | 246TNT | 0.635000 | 112.0000 | .911 | 0 | 56 | 40 |
| 949 | ES | UW32 | EXPLOSIVES/WATER/HPLC-U | 24DNT | 0.063700 | 21.2000 | .929 | 0 | 56 | 40 |
| 950 | ES | UW32 | EXPLOSIVES/WATER/HPLC-U | 26DNT | 0.073800 | 24.4000 | .985 | 0 | 56 | 40 |
| 958 | ES | UW32 | EXPLOSIVES/WATER/HPLC-U | 2A46DT | 0.158000 | 22.0000 | .973 | 0 | 56 | 40 |
| 959 | ES | UW32 | EXPLOSIVES/WATER/HPLC-U | 2NT | 0.406000 | 122.6000 | .936 | 0 | 56 | 40 |
| 960 | ES | UW32 | EXPLOSIVES/WATER/HPLC-U | 3NT | 1.400000 | 116.8000 | .934 | 0 | 56 | 40 |
| 957 | ES | UW32 | EXPLOSIVES/WATER/HPLC-U | 4A26DT | 1.570000 | 20.8000 | 1.12 | 0 | 56 | 40 |
| 961 | ES | UW32 | EXPLOSIVES/WATER/HPLC-U | 4NT | 1.110000 | 120.4000 | .913 | 0 | 56 | 40 |
| 951 | ES | UW32 | EXPLOSIVES/WATER/HPLC-U | HMX | 1.210000 | 120.8000 | 1.00 | 0 | 56 | 40 |
| 952 | ES | UW32 | EXPLOSIVES/WATER/HPLC-U | NB | 0.645000 | 129.0000 | .919 | 0 | 56 | 40 |
| 953 | ES | UW32 | EXPLOSIVES/WATER/HPLC-U | RDX | 1.170000 | 116.8000 | .952 | 0 | 56 | 40 |
| 954 | ES | UW32 | EXPLOSIVES/WATER/HPLC-U | TETRYL | 2.489000 | 107.5000 | 1.00 | 0 | 56 | 40 |
| 354 | ES | V8 | PESTICIDES/WATER/GCEC | DBCP | 0.112000 | 2.0100 | .825 | 0 | 7 | 40 |
| 355 | ES | V9 | METALS/SOIL/CVAA | HG | 0.050000 | 1.0000 | 1.02 | 28 | 0 | 0 |
| 356 | ES | VV9 | PESTICIDES/SOIL/GCNPD | ATZ | 0.251000 | 5.0200 | .915 | 0 | 7 | 40 |
| 357 | ES | VV9 | PESTICIDES/SOIL/GCNPD | DDVP | 0.700000 | 5.1500 | .681 | 0 | 7 | 40 |
| 358 | ES | VV9 | PESTICIDES/SOIL/GCNPD | MLTHN | 0.251000 | 5.0200 | .929 | 0 | 7 | 40 |
| 359 | ES | VV9 | PESTICIDES/SOIL/GCNPD | PRTHN | 0.251000 | 5.0100 | .898 | 0 | 7 | 40 |
| 360 | ES | VV9 | PESTICIDES/SOIL/GCNPD | SUPONA | 0.250000 | 4.9900 | .862 | 0 | 7 | 40 |
| 361 | ES | W8 | AROMATICS/WATER/GCPID | 13DMB | 1.350000 | 8.6800 | .972 | 14 | 0 | 0 |
| 362 | ES | W8 | AROMATICS/WATER/GCPID | C6H6 | 1.340000 | 8.6700 | .959 | 14 | 0 | 0 |
| 363 | ES | W8 | AROMATICS/WATER/GCPID | ETC6H5 | 1.280000 | 8.9000 | 1.10 | 14 | 0 | 0 |
| 364 | ES | W8 | AROMATICS/WATER/GCPID | MEC6H5 | 1.210000 | 8.5500 | .962 | 14 | 0 | 0 |
| 365 | ES | W8 | AROMATICS/WATER/GCPID | XYLEN | 2.470000 | 17.5000 | .966 | 14 | 0 | 0 |
| 366 | ES | W9 | VOLATILES/SOIL/GCMS | 111TCE | 0.250000 | 25.0000 | .955 | 0 | 7 | 40 |
| 367 | ES | W9 | VOLATILES/SOIL/GCMS | 112TCE | 0.250000 | 25.0000 | 1.01 | 0 | 7 | 40 |
| 368 | ES | W9 | VOLATILES/SOIL/GCMS | 11DCLE | 0.250000 | 25.0000 | 1.02 | 0 | 7 | 40 |
| 369 | ES | W9 | VOLATILES/SOIL/GCMS | 12DCD4 | 0.850000 | 25.0000 | 1.02 | 0 | 7 | 40 |
| 370 | ES | W9 | VOLATILES/SOIL/GCMS | 12DCE | 0.250000 | 25.0000 | 1.00 | 0 | 7 | 40 |
| 371 | ES | W9 | VOLATILES/SOIL/GCMS | 12DCLE | 0.280000 | 25.0000 | 1.02 | 0 | 7 | 40 |
| 372 | ES | W9 | VOLATILES/SOIL/GCMS | 13DMB | 0.250000 | 25.0000 | 1.05 | 0 | 7 | 40 |
| 373 | ES | W9 | VOLATILES/SOIL/GCMS | BCHPD | 0.250000 | 25.0000 | 1.05 | 0 | 7 | 40 |
| 374 | ES | W9 | VOLATILES/SOIL/GCMS | C6H6 | 0.250000 | 25.0000 | 1.06 | 0 | 7 | 4 |
| 375 | ES | W9 | VOLATILES/SOIL/GCMS | CCL4 | 0.250000 | 25.0000 | 1.03 | 0 | 7 | 4 |
| 376 | ES | W9 | VOLATILES/SOIL/GCMS | CD2CL2 | 1.100000 | 25.0000 | .955 | 0 | 7 | 40 |
| 377 | ES | W9 | VOLATILES/SOIL/GCMS | CH2CL2 | 0.250000 | 25.0000 | .964 | 0 | 7 | 40 |
| 378 | ES | W9 | VOLATILES/SOIL/GCMS | CHCL3 | 0.250000 | 25.0000 | 1.06 | 0 | 7 | 40 |
| 379 | ES | W9 | VOLATILES/SOIL/GCMS | CLC6H5 | 0.250000 | 25.0000 | 1.04 | 0 | 7 | 40 |
| 380 | ES | W9 | VOLATILES/SOIL/GCMS | DBCP | 0.330000 | 25.0000 | .980 | 0 | 7 | 40 |
| 381 | ES | W9 | VOLATILES/SOIL/GCMS | DCPD | 0.270000 | 27.0000 | 1.07 | 0 | 7 | 40 |
| 382 | ES | W9 | VOLATILES/SOIL/GCMS | DMDS | 0.250000 | 25.0000 | 1.03 | 0 | 7 | 40 |
| 383 | ES | W9 | VOLATILES/SOIL/GCMS | ETBD10 | 0.730000 | 25.0000 | 1.06 | 0 | 7 | 40 |
| 384 | ES | W9 | VOLATILES/SOIL/GCMS | ETC6H5 | 0.250000 | 25.0000 | 1.06 | 0 | 7 | 40 |
| 385 | ES | W9 | VOLATILES/SOIL/GCMS | MEC6H5 | 0.250000 | 25.0000 | 1.05 | 0 | 7 | 40 |
| 386 | ES | W9 | VOLATILES/SOIL/GCMS | MIBK | 0.500000 | 25.0000 | .935 | 0 | 7 | 40 |
| 387 | ES | W9 | VOLATILES/SOIL/GCMS | TCLEE | 0.250000 | 25.0000 | 1.04 | 0 | 7 | 40 |
| 388 | ES | W9 | VOLATILES/SOIL/GCMS | TRCLE | 0.250000 | 25.0000 | 1.03 | 0 | 7 | 40 |
| 389 | ES | W9 | VOLATILES/SOIL/GCMS | XYLEN | 0.500000 | 50.0000 | 1.09 | 0 | 7 | 40 |
| 390 | ES | WW9 | AROMATICS/SOIL/GCPID | 13DMB | 0.053000 | 4.2800 | .930 | 14 | 0 | 0 |
| 391 | ES | WW9 | AROMATICS/SOIL/GCPID | C6H6 | 0.081000 | 4.3400 | .945 | 14 | 0 | 0 |
| 392 | ES | WW9 | AROMATICS/SOIL/GCPID | ETC6H5 | 0.043000 | 4.2700 | .952 | 14 | 0 | 0 |
| 393 | ES | WW9 | AROMATICS/SOIL/GCPID | MEC6H5 | 0.096000 | 4.3000 | 1.00 | 14 | 0 | 0 |
| 394 | ES | WW9 | AROMATICS/SOIL/GCPID | XYLEN | 0.086000 | 8.6400 | .894 | 14 | 0 | 0 |
| 395 | ES | X8 | ANIONS/WATER/IONCHROM | CL | 4800.000000 | 300000.0000 | .910 | 28 | 0 | 0 |
| 396 | ES | X8 | ANIONS/WATER/IONCHROM | F | 1220.000000 | 10000.0000 | 1.03 | 28 | 0 | 0 |
| 397 | ES | X8 | ANIONS/WATER/IONCHROM | SO4 | 10000.000000 | 600000.0000 | 1.00 | 28 | 0 | 0 |
| 398 | ES | XX9 | ANIONS/SOIL/IONCHROM | CL | 16.400000 | 205.0000 | .994 | 28 | 0 | 0 |
| 399 | ES | XX9 | ANIONS/SOIL/IONCHROM | F | 4.500000 | 51.2000 | .871 | 28 | 0 | 0 |
| 400 | ES | XX9 | ANIONS/SOIL/IONCHROM | SO4 | 95.300000 | 512.0000 | .988 | 28 | 0 | 0 |
| 401 | ES | Y8 | HALOCARBONS/WATER/GCCON | 111TCE | 1.700000 | 196.0000 | 1.15 | 14 | 0 | 0 |
| 402 | ES | Y8 | HALOCARBONS/WATER/GCCON | 112TCE | 1.000000 | 196.0000 | 1.03 | 14 | 0 | 0 |
| 403 | ES | Y8 | HALOCARBONS/WATER/GCCON | 11DCE | 1.100000 | 196.0000 | 1.17 | 14 | 0 | 0 |
| 404 | ES | Y8 | HALOCARBONS/WATER/GCCON | 11DCLE | 1.200000 | 194.0000 | 1.15 | 14 | 0 | 0 |
| 405 | ES | Y8 | HALOCARBONS/WATER/GCCON | 12DCE | 1.200000 | 194.0000 | 1.17 | 14 | 0 | 0 |
| 406 | ES | Y8 | HALOCARBONS/WATER/GCCON | 12DCLE | 0.610000 | 196.0000 | 1.03 | 14 | 0 | 0 |
| 407 | ES | Y8 | HALOCARBONS/WATER/GCCON | CCL4 | 2.400000 | 200.0000 | 1.01 | 14 | 0 | 0 |
| 408 | ES | Y8 | HALOCARBONS/WATER/GCCON | CH2CL2 | 5.000000 | 198.0000 | 1.03 | 14 | 0 | 0 |
| 409 | ES | Y8 | HALOCARBONS/WATER/GCCON | CHCL3 | 1.400000 | 194.0000 | 1.17 | 14 | 0 | |
| 410 | ES | Y8 | HALOCARBONS/WATER/GCCON | CLC6H5 | 0.580000 | 200.0000 | 1.08 | 14 | 0 | |
| 411 | ES | Y8 | HALOCARBONS/WATER/GCCON | TCLEE | 1.300000 | 196.0000 | 1.06 | 14 | 0 | 0 |
| 412 | ES | Y8 | HALOCARBONS/WATER/GCCON | TRCLE | 1.100000 | 194.0000 | 1.10 | 14 | 0 | 0 |
| 413 | ES | YY8 | AGENTPRODS/WATER/HPLC | TDGCL | 65.900000 | 4880.0000 | .688 | 0 | 7 | 40 |
| 414 | ES | YY8 | AGENTPRODS/WATER/HPLC | TDGCLA | 52.700000 | 1780.0000 | .930 | 0 | 7 | 40 |
| 415 | ES | YY9 | HALOCARBONS/SOIL/GCCON | 111TCE | 0.120000 | 0.9800 | 1.08 | 14 | 0 | 0 |
| 416 | ES | YY9 | HALOCARBONS/SOIL/GCCON | 112TCE | 0.120000 | 1.0000 | 1.09 | 14 | 0 | 0 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 417 | ES | YY9 | HALOCARBONS/SOIL/GCCON | 11DCE | 0.120000 | 0.9400 | 1.12 | 14 | 0 | 0 |
| 418 | ES | YY9 | HALOCARBONS/SOIL/GCCON | 11DCLE | 0.130000 | 0.9700 | 1.09 | 14 | 0 | 0 |
| 419 | ES | YY9 | HALOCARBONS/SOIL/GCCON | 12DCE | 0.150000 | 1.0200 | 1.16 | 14 | 0 | 0 |
| 420 | ES | YY9 | HALOCARBONS/SOIL/GCCON | 12DCLE | 0.080000 | 1.0000 | 1.10 | 14 | 0 | 0 |
| 421 | ES | YY9 | HALOCARBONS/SOIL/GCCON | CCL4 | 0.120000 | 1.0300 | 1.00 | 14 | 0 | 0 |
| 422 | ES | YY9 | HALOCARBONS/SOIL/GCCON | CH2CL2 | 0.150000 | 0.9900 | 1.10 | 14 | 0 | 0 |
| 423 | ES | YY9 | HALOCARBONS/SOIL/GCCON | CHCL3 | 0.100000 | 1.0400 | 1.04 | 14 | 0 | 0 |
| | ES | YY9 | HALOCARBONS/SOIL/GCCON | CLC6H5 | 0.180000 | 1.0200 | 1.11 | 14 | 0 | 0 |
| | ES | YY9 | HALOCARBONS/SOIL/GCCON | TCLEE | 0.120000 | 1.0100 | 1.03 | 14 | 0 | 0 |
| | ES | YY9 | HALOCARBONS/SOIL/GCCON | TRCLE | 0.090000 | 1.0000 | 1.06 | 14 | 0 | 0 |
| 427 | ES | Z8 | VOLATILES/WATER/GCFID | BCHPD | 7.340000 | 102.0000 | .680 | 0 | 7 | 40 |
| 428 | ES | Z8 | VOLATILES/WATER/GCFID | DCPD | 5.120000 | 102.0000 | .740 | 0 | 7 | 40 |
| 429 | ES | Z8 | VOLATILES/WATER/GCFID | MIBK | 5.240000 | 105.0000 | .860 | 0 | 7 | 40 |
| 430 | ES | ZZ9 | VOLATILES/SOIL/GCFID | BCHPD | 5.080000 | 102.0000 | .856 | 0 | 7 | 40 |
| 431 | ES | ZZ9 | VOLATILES/SOIL/GCFID | DCPD | 5.120000 | 102.0000 | .898 | 0 | 7 | 40 |
| 432 | ES | ZZ9 | VOLATILES/SOIL/GCFID | MIBK | 5.240000 | 105.0000 | .898 | 0 | 7 | 40 |

# APPENDIX B

## Field/ Laboratory Interaction SOPs

Table of Contents
Appendix B

# B.1

# Sample Containers and Cleanup

## B.1 LABORATORY CONTAINER CLEANING PROCEDURES

ESE intends to use commercially cleaned sample containers whenever possible (except as noted). Table B-1 summarizes the application of these cleaning procedures. Any containers prepared in-house (when necessary) will meet these or equivalent specifications. Sample-kit containers are stored in clean, dust-free areas segregated from the analytical laboratory and solvent/reagent storage areas. Audits of containers to document freedom from contaminants are performed by supplying the various blanks to routine analysis.

DI water is defined as ESE water that has been treated by passing it through a standard resin column and an activated carbon unit. The water contains no detectable (ESE's routine detection limits) heavy metals or inorganic compounds of analytical interest and is relatively free of organic compounds. The water is acceptable for the initial rinsing of laboratory glassware and field equipment. Ultra-pure water, used for equipment and field blanks, is defined as ESE water that has been additionally treated through a Milli-Q treatment system and contains no organic compounds of analytical interest above ESE's routine detection limits. Organic-free water, used for trip blanks, is prepared by purging American Society for Testing and Materials (ASTM) Type 2 water at 60 C for 24 hours with Grade 6 helium.

DI water other than ESE treated water may be used if it is of documented equivalent quality. Use of commercially "deionized" or "distilled" water is discouraged because it often contains phthalate esters.

B-1

Table . Sample Container Cleaning Procedures Within the Laboratory

| Analysis/Parameter | Container Type | Matrix | Fraction Code | Cleaning Protocol* |
|---|---|---|---|---|
| Organic extractables include GC, HPLC, GC/MS, and Total Phenols Analyses | Glass jar with Teflon®-lined cap | Water | MS, EC, HB, UP, NP, LC, W, Z | A |
| | Glass jar with Teflon®-lined cap | Soil/ Sediment/ Tissue | SS | A |
| Organic purgeables including GC and GC/MS Analyses, TOX, Aldicarb | Glass septum vial with Teflon®-lined septum | Water | V, VP, ED, AL, XP | B |
| | Wide-mouth glass jar with Teflon®-lined cap | Soil/Tissue | SV | B |
| Metals | Linear polyethylene cubitainer with polyethylene cap | Water | N | C |
| | Glass jar with Teflon®-lined cap (or new plastic) | Soil/ Sediment/ Tissue | SS | A |
| Inorganics include total cyanide, alkalinity, acidity, residues, BOD, color, MBAS, COD, TOC, chloride, turbidity, sulfate, bromide, sulfide, fluoride, nutrients, and radionuclides | Linear polyethylene cubitainer with polyethylene cap | Water | C, B, S, H, R | D |
| | Glass jar with Teflon®-lined cap (or new plastic) | Soil/Tissue | SS | A |

Table B-1. Sample Container Cleaning Procedures With the Laboratory (Continued, Page 2 of 2)

| Analysis/Parameter | Container Type | Matrix | Fraction Code | Cleaning Protocol* |
|---|---|---|---|---|
| Oil and grease (O&G), odor | Glass jar with Teflon®-lined cap | Water | O,OD | A |
| Oil and grease (O&G) | Glass jar with Teflon®-lined cap | Soil/ Sediment | SS | A |
| Bacteriologicals | Plastic Whirlpak or equivalent | Water | M | E |

Note: GC/MS = gas chromatography/mass spectrography.
GC/HPLC = gas chromatography/high performance liquid chromatography.
Glass = amber for all organic water analyses.
TOX = total organic halide.

| *Cleaning Protocol A | B | C | D | E | Specifications |
|---|---|---|---|---|---|
| X | X | X | | | Wash with hot tap water using laboratory-grade, nonphosphate detergent. |
| X | X | X | | | Rinse 3 times with tap water. |
| X | | X | | | Rinse with 1:1 nitric acid (reagent-grade nitric acid diluted with ASTM Type 1 deionized water). |
| X | X | X | | | Rinse 3 times with ASTM Type 1 deionized water. |
| X | | | | | Rinse with pesticide-grade methylene chloride using 20 mL per 64-oz bottle, 10 mL per 32- or 16-oz bottle, or 5 mL per 8- or 4-oz bottle. |
| X | X | | | | Oven dry at 105° to 125°C for 1 hour. |
| | | X | | | Invert and air dry in contaminant-free environment. |
| | | | X | | No cleaning required; use new cubitainers (only). |
| | | | | X | Use sterile, prepackaged plas c container or equivalent for subcontracted work. |

Source: ESE, 1989.

TABLE B-1. SUMMARY OF METHODS, CONTAINER TYPES, CLEANING PROCEDURES, VOLUME REQUIRED, HOLDING TIMES ETC.

| | ARMY METHOD No. | REFERENCE METHOD No. | METHOD NAME | CONTAINER TYPE/SIZE | CLEANING REQUIRED | FRACTION@ DESIGNATION | ANALYTICAL VOLUMES | PRESERVATION REQUIREMENTS | HOLDING TIMES |
|---|---|---|---|---|---|---|---|---|---|
| GC/MS | | | | | | | | | |
| | LM18 | 8270 | BNAs IN SOIL BY GC/MS | AMBER GLASS/0.5L | A | SS | 50g | CHILL | 7/40D |
| | UM18 | 625 | BNAs IN WATER BY GC/MS | AMBER GLASS/1L | A | MS | 1L | CHILL | 7/40D |
| | LM19 | 8240 | VOCs IN SOIL BY GC/MS | 60 mL VIALS | B | SV | 5g | CHILL | 14D |
| | UM20 | 624 | VOCs IN WATER BY GC/MS | 60 mL VIALS | B | VP | 5 mL | HCL,pH<2 | 14D |
| PEST. & PCBs | | | | | | | | | |
| | LH10 | 8080 | OCPs IN SOIL BY GC-EC | AMBER GLASS/0.5L | A | SS | | CHILL | 7/40D |
| | UH13 | 608 | OCPs IN WATER BY GC-EC | AMBER GLASS/1L | A | EC | 1L | CHILL | 7/40D |
| | LH16 | 8080 | PCBs IN SOIL BY GC-EC | AMBER GLASS/0.5L | A | SS | | CHILL | 7/40D |
| | UH02 | 608 | PCBs IN WATER BY GC-EC | AMBER GLASS/1L | A | EC | 1L | CHILL | 7/40D |
| EXPL. | | | | | | | | | |
| | LW12 | | EXPL.s IN SOIL BY HPLC | AMBER GLASS/0.5L | A | SS | | CHILL | 56/40D |
| | UW14 | | EXPL.s IN WATER BY HPLC | AMBER GLASS/1L | A | LC | 1L | CHILL | 56/40D |
| | UW19 | | PETN/NG IN WATER BY HPLC | AMBER GLASS/1L | A | LC | 1L | CHILL | 56/40D |
| METALS | | | | | | | | | |
| | JS11 | 6010 | METALS IN SOIL BY ICAP | AMBER GLASS/0.5L | A | SS | 10g | CHILL | 6M |
| | SS10 | 200.7 | METALS IN WATER BY ICAP | PLASTIC/1L | C | N | 100mL | HNO3,pH<2 | 6M |
| | JB01 | 7471 | HG IN SOIL BY CVAA | AMBER GLASS/0.5L | A | SS | 10g | CHILL | 28D |
| | SB01 | 245.1 | HG IN WATER BY CVAA | PLASTIC/1L | C | N | 250mL | HNO3,pH<2 | 28D |
| | JD15 | 7740 | SE IN SOIL BY GFAA | AMBER GLASS/0.5L | A | SS | 10g | CHILL | 6M |
| | SD21 | 270.2 | SE IN WATER BY GFAA | PLASTIC/1L | C | N | 100mL | HNO3,pH<2 | 6M |
| | JD16 | 7911 | V IN SOIL BY GFAA | AMBER GLASS/0.5L | A | SS | 10g | CHILL | 6M |
| | SD19 | 200.7 | V IN WATER BY GFAA | PLASTIC/1L | C | N | 100mL | HNO3,pH<2 | 6M |
| | JD17 | 7421 | PB IN SOIL BY GFAA | AMBER GLASS/0.5L | A | SS | 10g | CHILL | 6M |
| | SD20 | 239.2 | PB IN WATER BY GFAA | PLASTIC/1L | C | N | 100mL | HNO3,pH<2 | 6M |
| | JD18 | 7761 | AG IN SOIL BY GFAA | AMBER GLASS/0.5L | A | SS | 10g | CHILL | 6M |
| | SD23 | 272.2 | AG IN WATER BY GFAA | PLASTIC/1L | C | N | 100mL | HNO3,pH<2 | 6M |
| | JD19 | 7060 | AS IN SOIL BY GFAA | AMBER GLASS/0.5L | A | SS | 10g | CHILL | 6M |
| | SD22 | 206.2 | AS IN WATER BY GFAA | PLASTIC/1L | C | N | 100mL | HNO3,pH<2 | 6M |
| ANIONS | | | | | | | | | |
| | KT05 | 300.0 | SULFATE IN SOIL | AMBER GLASS/0.5L | A | SS | 2g | CHILL | 28D |
| | TT10 | 300.0 | SULFATE IN WATER | PLASTIC/1L | D | C | 10mL | CHILL | 28D |
| | KF10 | 353.2 | NO2+NO3 IN SOIL BY TECH. | AMBER GLASS/0.5L | A | SS | 2g | CHILL | 28D |
| | TF22 | 353.2 | NO2+NO3 IN WATER BY TECH. | PLASTIC/1L | D | S | 10mL | H2SO4,pH<2 | 28D |
| | KF14 | 365.1 | TOTAL PHOSPHATE IN SOIL | AMBER GLASS/0.5L | A | SS | 1g | CHILL | 28D |
| | TF27 | 365.1 | TOTAL PHOSPHATE IN WATER | PLASTIC/1L | D | S | 75mL | H2SO4,pH<2 | 28D |
| | | 9071/9073 | OIL AND GREASE/TRPH IN SOIL | AMBER GLASS/0.5L | A | SS | 15g | CHILL | 28D |
| | | 413.2 | OIL AND GREASE/TRPH IN WATER | AMBER GLASS/1L | A | O | 1L | H2SO4,pH<2 | 28D |

@ ALL METHODS WITH A SS OR A N FRACTION DESIGNATION WILL BE IN 1 OR 2 ACTUAL CONTAINERS

TABLE B-1. (continued) SAMPLE CLEANING PROCEEDURES WITH THE LABORATORY

| CLEANING PROTOCOL | | | | | SPECIFICATION |
|---|---|---|---|---|---|
| A | B | C | D | E | |
| X | X | X | | | WASH WITHHOT TAP WATER USING LABORATORY-GRADE, NON-PHOSPHATE DETERGENT |
| X | X | X | | | RINSE THREE TIMES WITH TAP WATER |
| X | | X | | | RINSE WITH 1:1 NITRIC ACID (REAGENT-GRADE NITRIC ACID DILUTED WITH ASTM TYPE I DEIONIZED WATER) |
| X | X | X | | | RINSE THREE TIMES WITH ASTM TYPE 1 DEIONIZED WATER. |
| X | | | | | RINSE WITH PESTICIDE-GRADE HEXANE USING 20 mL PER 64-OZ BOTTLE, 10 mL PER 32- OR 16-OZ. BOTTLE, OR 5 mL PER 8- OR 4-OZ. BOTTLE. |
| X | X | | | | OVEN DRY AT 105 DEG. TO 125 DEG. C FOR ONE HOUR. |
| | | X | | | INVERT AND AIR DRY IN CONTAMINANT-FREE ENVIRONMENT. |
| | | | X | | CLEANING PERFORMED BY SUPPLIER ACCORDING TO U.S. EPA PROTOCOL |
| | | | | X | USE STERILE, PREPACKAGED PLASTIC CONTAINER OF EQUIVALENT |

# B.2

## Sampling Guidance

B.2 SAMPLING GUIDANCE

Appendix G in the January 1990 USATHAMA QA Plan presents standard operating procedures for field operations. This Master QA plan is for laboratory operations in support of different field operations contracts. Standard operating procedures required by the USATHAMA QA plan and applicability to this Master Laboratory QA plan are as follows:

| | |
|---|---|
| Training | NRQ in this Manual |
| Sample Management | NRQ -Case by case input |
| Numbering and Labeling | NRQ -Case by case input for incorporating ESE prepared labels and project numbering |
| Sample Tracking | NRQ -provide feedback to project manager of samples received and ID's |
| Sample Containers | NRQ -case by case input |
| Sample Preservation and Storage | NRQ -use Appendix B.4 for guidance |
| Holding Times | NRQ -use Appendix B.4 for guidance |
| Shipping | NRQ -case by case input of carrier delivering to ESE |
| Decontamination | NRQ in this Manual |
| Sample Collection Procedures | NRQ in this Manual |
| Corrective Action | NRQ in this Manual |
| Records Management | NRQ in this Manual |
| Chemical and Sample Disposal | NRQ in this Manual |
| Reporting field data | NRQ in this Manual |
| Field Analyses | Not required at this time. |

B.3

Field Laboratory Interaction

## B.3 PREFIELD ACTIVITY

Corporate policy dictates that prefield briefing meetings/conference calls be held prior to any field investigations involving the collection of laboratory samples. These meetings are intended to assure that all necessary departments are aware of the field activity and can plan accordingly.

Within corporate headquarters (Gainesville), the Project Manager and/or Field Team Leader must schedule a meeting with at least the Laboratory Coordinator and Project QA Supervisor. Regional office personnel must initiate a conference call with the appropriate laboratory coordinator (regional laboratory or Gainesville) and Project QA Supervisor.

A Field Trip Plan Approval Form (see Figure 4-2) is filled out, and approval is documented by the signatures of the personnel on the form. For regional offices, the date of the conference call is placed on the signature line. These items should be discussed at the pre-field meeting, and understood by every member of the field team. Phone numbers and points of contacts should be established and available. Project specific details (field QC requirements, chain-of-custody requirements, schedules, holdingtimes, etc.) should be discussed.

FIELD AND LABORATORY INTERACTION

Throghout the field activities, in which samples are collected, daily communication between the field-team leader and the laboratory coordinator is necessary. Items that need to be discussed include, but are not limited to:

1. Samples collected and shipped previous day,
2. Samples that are projected to be collected that day,
3. Documentation (logsheet completed correctly?), a description of ESE label and logsheet are attached,
4. Preservation (performed correctly?),
5. Beakage (packing of samples).

QAP 04/89 P

## FIELD TRIP PLAN APPROVAL FORM

Project No. ____________

Project Name: ____________

Field Trip Site: ____________

Field Trip Responsibility (Subproj. or Proj. Mngr.) ____________

Field Team Leader: ____________

Laboratory Coordinator: ____________

Field Team Members:

____________ ____________

____________ ____________

____________ ____________

____________ ____________

**SCHEDULING INFORMATION:**

Field Trip Briefing Mtg ____________ (Date) ____________ (Time)

Departure ESE ____________ (Date) ____________ (Time)

Site Arrival ____________ (Date) ____________ (Time)

Site Departure ____________ (Date) ____________ (Time)

Arrive ESE ____________ (Date) ____________ (Time)

**PLANNING INFORMATION:**

The following information must be attached (check to indicate):

____________ Sampling and Shipping Schedule; Lab/Field Contacts Established

____________ Sampling Location Layout

____________ Samples to be Collected and Fraction

____________ List of all Parameters to be Measured On-Site

____________ List of Field Equipment Requested

**APPROVALS:**

____________ Laboratory Coordinator (Date) ____________ Proj. or Subproj. Manager (Date)

____________ Field Team Leader (Date) ____________ QA Manager (Date)

REMARKS: ____________

____________

____________

____________

____________

cc: Project Director / Project Manager

Signature ____________ Date ____________

Figure 4-2
FIELD TRIP APPROVAL FORM

SOURCE: HUNTER/ESE, 1989.

HUNTER/ESE

Should problems and delays arise in the field, this information can be passed along to laboratory personnel, and plans can be adjusted as necessary.

ESE FIELD LOGSHEET AND LABEL - A Description

Refer to the attached example.

1. Date of generation of the field group and logsheet.

2. FIELD GROUP - This is an alphanumeric label, assigned by the laboratory coordinator, that identified this particular sample effort. The name must not be altered once the field group has been set-up.

3. PROJECT NUMBER - The first seven digits represent a unique numeric identifier for the project, the four digits suffix identifies a discrete analytical task performed as part of that project.

4. PROJECT NAME - Client's name and/or project descriptor.

5. LAB COORD. - The laboratory Coordinator (LC) responsible for this field group.

6. ESE # - The field group sample sequence number, an integer that is combined with the field group name (i.e., FTBLS1*199) to serve as an unique identifier for that sample. The number should not be altered once set-up.

7. SITE/STA - The site or station identification number. This alphanumeric label is used to identify the physical location or sampling point (well, test bore, sediment, etc.) where the sample was obtained. This ID may be altered to reflect changes in the field and should be limited to 9 characters.

8. HAZ? - The hazard code which alerts field personnel if special precautions should be taken when handling and processing the sample. The key to these codes are printed on the logsheet itself in the section labeled "NOTE".

9. FRACTIONS - These codes inform sampling personnel how much of the matrix is required, its storage requirements, type of container and method of preservation. Each fraction collected and shipped should be circle by sample collection personnel. See "Key to Fraction Codes" for more information.

10. DATE - Date of collection.

11. TIME - Time of collection.

12. PARAMETER LIST - an alphanumerically labeled list of the analysis and procedures that are to be performed on the sample as requested by the LC.

13. Record FIELD DATA in this area, including such things as field pH and conductivity, or Army parameters, as appropriate.

13A. Record the Sequence Number (ESE # [6.]) of the sample that was replicated. This is very important in the lab's review of the data and subsequent submittal to the Army's database.

ESE FIELD LOGSHEET AND LABEL - A Description (Continued, Page 2 of 2)

14. These three blank lines are for signatures of individuals who are handling the samples to document the chain of custody. Sampler signs line 1, left side, and also initials label. When samples are relinquished to Fed. Ex. (or other courier) record the airbill number in the "REC'D BY" space.

15. SAMPLER: NEXT SHIPMENT - Record date of next shipment of samples in this field group (if any).

16. NUMBER SAMPLES - Record number of samples that will be sent in the next shipment (if any).

Items 17 through 20 will be recorded by the Sample Custodian (at the laboratory).

17. CUSTODY SEALS INTACT - Indicates whether or not custody tapes are intact (if any) when received at the laboratory.

18. SAMPLES ICED - Indicates whether or not the samples were received at the laboratory on ice.

19. PRESERVATIONS AUDITED? - Indicates whether or not the preservations were performed and/or performed correctly.

20. PROBLEMS? - Problems with the sample shipment, receipt, packing, and/or preservations (if any) would be noted here.

ıter/ESE, .. 01-26-90 ① *** FIELD LOGSHEET *** FIELD GROUP: FTBLW1 ②

JECT NUMBER 3904067 0201 ③ PROJECT NAME: CE - FT. BLISS ④ LAB COORD. JACKIE HARGROVE ⑤

| # | SITE/STA ⑦ | HAZ? ⑧ | FRACTIONS (CIRCLE) ⑨ | DATE ⑩ | TIME ⑪ | PARAMETER LIST ⑫ | pH | Cond. ⑬ | Water T. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | S39-SW-1 | | EC EC HB HB MS MS<br>N NP NP O O O VP<br>VP VP VP | | | FTBLSW | | | |
| 2 | S39-SW-2 | | EC EC HB HB MS MS<br>N NP NP O O O VP<br>VP VP VP | | | FTBLSW | | | |
| 3 | S39-SW-3 | | EC EC HB HB MS MS<br>N NP NP O O O VP<br>VP VP VP | | | FTBLSW | | | |
| 4 | S39-SW-4 | | EC EC HB HB MS MS<br>N NP NP O O O VP<br>VP VP VP | | | FTBLSW | | | |
| 5 | S39-SW-5 | | EC EC HB HB MS MS<br>N NP NP O O O VP<br>VP VP VP | | | FTBLSW | | | |
| 6 | S39-SW-6 | | EC EC HB HB MS MS<br>N NP NP O O O VP<br>VP VP VP | | | FTBLSW | | | |
| 7 | S39-SW-DP 13A | | EC EC HB HB MS MS<br>N NP NP O O O VP<br>VP VP VP | | | FTBLSW | | | |

E -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE, TIME, FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I-IGNITABLE C-CORROSIVE R-REACTIVE T-TOXIC WASTE H-OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

NQUISHED BY: (NAME/ORGANIZATION/DATE/TIME) VIA: REC'D BY (NAME/ORGANIZATION/DATE/TIME)

14

PLER: MORE SAMPLES TO BE SHIPPED? 15 IF YES, ANTICIPATED # 16 TO SHIP ON / /

PLE CUSTODIAN: Custody Seals Intact? 17 Samples Iced? 18 Preservations Audited? 19 Problems? 20

LABEL:

③
PRJ# 3904067 0201 S39-SW-1 ⑦
CE - FT. BLISS ④
② FTBLW1 * 1 ⑥ -EC ⑨
SAMPLER ⑭ DATE ⑩ TIME ⑪
⑬ COND ⑬

# B.4

# Preservation and Holding Time Requirements

Table H-1. Containers, Preservation, Storage, and Holding Times[a]

Table H-1. Containers, Preservation, Storage, and Holding Times[a]

| Parameter | Container[b] Water | Container[b] Soil | Preservative[c,d] Water | Preservative[c,d] Soil | Maximum Holding Time for all Matrices[e] |
|---|---|---|---|---|---|
| INORGANIC TESTS | | | | | |
| Acidity | P | G | Cool, 4°C | Cool, 4°C | 14 days |
| Alkalinity | P | G | Cool, 4°C | Cool, 4°C | 14 days |
| Ammonia | P | G | Cool, 4°C<br>$H_2SO_4$ to pH <2 | Cool, 4°C | 28 days |
| Asbestos | P | G | Cool, 4°C | Cool, 4°C | 48 hours[f] |
| Bicarbonate | P | G | None Required | None Required | Analyze Immediately |
| Biochemical Oxygen Demand (BOD) and Carbonaceous BOD | P | G | Cool, 4°C | Cool, 4°C | 48 hours |
| Bromide | P | G | None Required | None Required | 28 days |
| Carbonate | P | G | None Required | None Required | Analyze Immediately |
| Chemical Oxygen Demand (COD) | P | G | Cool, 4°C<br>$H_2SO_4$ to pH <2 | Cool, 4°C | 28 days |
| Chloride | P | G | None Required | None Required | 28 days |
| Chlorine, Total Residual | P | N/A | None Required | N/A | Analyze Immediately |
| Color | P | N/A | Cool, 4°C | N/A | 48 hours |

## Table H-1. (Cont'd.)

| Parameter | Container[b] Water | Container[b] Soil | Preservative[c,d] Water | Preservative[c,d] Soil | Maximum Holding Time for all Matrices[e] |
|---|---|---|---|---|---|
| Cyanide, Total and Amenable to Chlorination | P | G | Cool, 4°C<br>NaOH to pH >12<br>0.6 g Ascorbic Acid[g] | Cool, 4°C | 14 days [h] |
| Dissolved Oxygen | | | | | |
| Probe | G Bottle and Top | N/A | None Required | N/A | Analyze Immediately |
| Winkler | G Bottle and Top | N/A | Fix On Site<br>Store in Dark | N/A | 8 hours |
| Fluoride | P | G | None Required | None Required | 28 days |
| Hardness | P | N/A | $HNO_3$ or $H_2SO_4$ to pH<2 | N/A | 6 months |
| Hydrazine | P | G | If not analyzed immediately, collect under acid. Add 90 ml of sample to 10 ml HCl. | Cool, 4°C | 7 days |
| Iodide | P | G | Cool, 4°C | Cool, 4°C | 24 hours |
| Iodine | P | G | None Required | None Required | Analyze Immediately |
| Kjeldahl and Organic Nitrogen | P | G | Cool, 4°C<br>$H_2SO_4$ to pH <2 | Cool, 4°C | 28 days |

Table H-1. (Cont'd.)

| Parameter | Container[b] Water | Container[b] Soil | Preservative[c,d] Water | Preservative[c,d] Soil | Maximum Holding Time for all Matrices[e] |
|---|---|---|---|---|---|
| Metals[i] | | | | | |
| Chromium VI | P | G | Cool, 4°C | Cool, 4°C | 24 hours |
| Mercury | P | G | $HNO_3$ to pH <2 | Cool, 4°C | 28 days |
| Others | P | G | $HNO_3$ to pH <2 | Cool, 4°C | 6 months |
| Nitrate | P | G | Cool, 4°C | Cool, 4°C | 48 hours |
| Nitrate plus Nitrite | P | G | Cool, 4°C<br>$H_2SO_4$ to pH <2 | Cool, 4°C | 28 days |
| Nitrite | P | G | Cool, 4°C | Cool, 4°C | 48 hours |
| Oil and Grease | G | G | Cool, 4°C<br>$H_2SO_4$ to pH <2 | Cool, 4°C | 28 days |
| Orthophosphate | P | G | Filter Immediately<br>Cool, 4°C | Cool, 4°C | 48 hours |
| pH | P | G | None Required | None Required | Analyze Immediately |
| Phenols | G | G | Cool, 4°C<br>$H_2SO_4$ to pH <2 | Cool, 4°C | 28 days |
| Phosphorous, Elemental | G | G | Cool, 4°C | Cool, 4°C | 48 hours |
| Phosphorous, Total | P,G | G | Cool, 4°C<br>$H_2SO_4$ to pH <2 | Cool, 4°C | 28 days |
| Silica, Dissolved or Total | P | G | Cool, 4°C | Cool, 4°C | 28 days |

Table H-1. (Cont'd.)

| Parameter | Container[b] Water | Container[b] Soil | Preservative[c,d] Water | Preservative[c,d] Soil | Maximum Holding Time for all Matrices[e] |
|---|---|---|---|---|---|
| Residue | | | | | |
| Filterable | P | N/A | Cool, $4^{o}C$ | N/A | 7 days |
| Settleable | P | N/A | Cool, $4^{o}C$ | N/A | 48 hours |
| Nonfilterable (TSS) | P | N/A | Cool, $4^{o}C$ | N/A | 7 days |
| Total | P | N/A | Cool, $4^{o}C$ | N/A | 7 days |
| Volatile | P | N/A | Cool, $4^{o}C$ | N/A | 7 days |
| Specific Conductance | P | G | Cool, $4^{o}C$ | Cool, $4^{o}C$ | 28 days |
| Sulfate | P | G | Cool, $4^{o}C$ | Cool, $4^{o}C$ | 28 days |
| Sulfide | P | G | Cool, $4^{o}C$<br>Add Zinc Acetate plus NaOH to pH >9 | Cool, $4^{o}C$ | 7 days |
| Sulfite | P | G | None Required | None Required | Analyze Immediately |
| Surfactants | P | G | Cool, $4^{o}C$ | Cool, $4^{o}C$ | 48 hours |
| Temperature | P | G | None Required | None Required | Analyze Immediately |
| Turbidity | P | N/A | Cool, $4^{o}C$ | N/A | 48 hours |
| ORGANIC TESTS[j] | | | | | |
| Acrolein and Acrylonitrile | S | S | Cool, $4^{o}C$<br>0.008% $Na_2S_2O_3$[g]<br>Adjust pH to 4-5[k] | Cool, $4^{o}C$ | 14 days[k] |

Table H-1. (Cont'd.)

| Parameter | Container[b] Water | Container[b] Soil | Preservative[c,d] Water | Preservative[c,d] Soil | Maximum Holding Time for all Matrices[e] |
|---|---|---|---|---|---|
| Benzidines[l] | G | G | Cool, 4°C[m]<br>0.008% $Na_2S_2O_3$[g]<br>pH 2-7 | Cool, 4°C | 7 days until extraction[n] |
| Chlorinated Hydrocarbons[l] | G | G | Cool, 4°C | Cool, 4°C | 7 days until extraction<br>40 days after extraction |
| Haloethers[l] | G | G | Cool, 4°C<br>0.008% $Na_2S_2O_3$[g] | Cool, 4°C | 7 days until extraction<br>40 days after extraction |
| Nitroaromatics and Isophorone[l] | G | G | Cool, 4°C<br>Store in Dark | Cool, 4°C<br>Store in Dark | 7 days until extraction<br>40 days after extraction |
| Nitrosamines[l,o] | G | G | Cool, 4°C<br>Store in Dark<br>0.008% $Na_2S_2O_3$[g] | Cool, 4°C<br>Store in Dark | 7 days until extraction<br>40 days after extraction |
| PCBs | G | G | Cool, 4°C | Cool, 4°C | 7 days until extraction<br>40 days after extraction |
| Pesticides[l] | G | G | Cool, 4°C<br>pH 5-9[p] | Cool, 4°C | 7 days until extraction<br>40 days after extraction |
| Phenols[l] | G | G | Cool, 4°C<br>0.008% $Na_2S_2O_3$[g] | Cool, 4°C | 7 days until extraction<br>40 days after extraction |
| Phthalate Esters[l] | G | G | Cool, 4°C | Cool, 4°C | 7 days until extraction<br>40 days after extraction |

Table H-1. (Cont'd.)

| Parameter | Container[b] Water | Container[b] Soil | Preservative[c,d] Water | Preservative[c,d] Soil | Maximum Holding Time for all Matrices[e] |
|---|---|---|---|---|---|
| Polynuclear Aromatic Hydrocarbons[f] | G | G | Cool, 4°C<br>0.008% $Na_2S_2O_3$[g]<br>Store in Dark | Cool, 4°C<br>Store in Dark | 7 days until extraction<br>40 days after extraction |
| Purgeable Aromatic Hydrocarbons | S | S | Cool, 4°C<br>0.008% $Na_2S_2O_3$[g]<br>HCl to pH <2[g] | Cool, 4°C | 14 days[g] |
| Purgeable Halocarbons | S | S | Cool, 4°C<br>0.008% $Na_2S_2O_3$[g] | Cool, 4°C | 14 days |
| TCDD[f] | G | G | Cool, 4°C<br>0.008% $Na_2SO_3$[g] | Cool, 4°C | 7 days until extraction<br>40 days after extraction |
| Total Organic Carbon | G | G | Cool, 4°C<br>HCl or $H_2SO_4$<br>to pH <2 | Cool, 4°C | 28 days |
| Total Organic Halogen | G | G | Cool, 4°C<br>1 ml of 0.1 M<br>sodium sulfite | Cool, 4°C | 7 days |

Analytes not listed should be preserved at 4°C and held not longer than 7 days.

[a]Preservatives and holding times are from Federal Register, Vol. 49, No. 209, Friday, October 26, 1984, Page 43260 and Characterization of Hazardous Waste Sites: A Methods Manual -- Volume II, Sampling Methods, Second Edition, EPA-600/4-84-076. Container requirements are consistent with these references.

[b]P = Polyethylene
G = Amber Glass with Teflon-lined cap
S = Glass Vial with Teflon-lined septum cap

[c]Sample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at the time of collection. When use of an automatic sampler makes it impossible to preserve each aliquot, samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.

[d]When any sample is to be shipped by common carrier or sent through the U.S. Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements in this table, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation, has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid ($HNO_3$) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid ($H_2SO_4$) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.3 or less).

[e]Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.

Some samples may not be stable for the maximum time period given in the table. A laboratory is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample integrity.

[f]If samples cannot be filtered within 48 hours, add 1 ml of a 2.71% solution of mercuric chloride to inhibit bacterial growth.

[g]Should only be used in the presence of residual chlorine.

[h]Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustment in order to determine if sulfide is present. If sulfide is present, it can be removed by addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.

[i]For dissolved metals, filter immediately on site before adding preservative.

[j]Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

[k]The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within three days of sampling.

[l]When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times must be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to $4^{\circ}C$, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting pH to 6-9; samples preserved in this manner may be held for 7 days before extraction and 40 days after extraction. Exceptions to this optimal preservation and holding time procedure are noted in footnotes g, m, and n.

[m]If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to $4.0 \pm 0.2$ to prevent rearrangement to benzidine.

[n]Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.

[o]For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.

[p]The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

[q]Sample receiving no pH adjustment must be analyzed within 7 days of sampling.

# APPENDIX C

## Relevant ESE Analytical Services SOPs

Table of Contents

Appendix C

C.1

Table of Contents of SOP Manual

GUIDE TO ESE STANDARD OPERATING PROCEDURES

These Standard Operating Procedures (SOPs) describe how ESE's Gainesville Chemistry Laboratory organizes and executes administrative, quality control (QC), housekeeping, safety, sample handling, and data management tasks which constitute the routine daily operation of the laboratory. Specific client requests or contractual obligations may supercede these procedures; These SOPs apply in all cases where there are no such specific requirements.

The SOPs are authorized by signature of the Laboratory Manager. The Laboratory Manager or his designate keeps the master copy, a copy of each SOP is distributed to each laboratory supervisor or department manager, and copies of selected SOPs are given to each employee performing analytical procedures.

C.2

Sample Receipt and Distribution
SOP 4122-04

SAMPLE RECEIPT AND DISTRIBUTION
STANDARD OPERATING PROCEDURE
SOP 4122-04

The Standard Operating Procedure (SOP) describes how ESE receives and distributes the sample and associated information to analytical departments.

DATE: 11/6/89 AUTHORIZED BY: John J. Moore
DISTRIBUTION:

# SAMPLE RECEIPT AND DISTRIBUTION

# SOP 4122-04

## 1.0 ABSTRACT

This Standard Operating Procedure (SOP) describes how ESE receives and distributes samples and associated information to analytical departments.

## 2.0 SUMMARY

This SOP describes chain-of-custody and sample documentation requirements. An overview of ESE's sample receipt and distribution system is presented schematically in Exhibit A. Sample storage is described in SOP 4122-05, sample login on ESE's computer network is described in SOP 4151-03, and sample container labelling is described in SOP 4151-02.

## 3.0 PROCEDURES

### 3.1 <u>SAMPLE SHIPMENT RECEIPT</u>

#### 3.1.1 COMMERCIAL DELIVERY

Receipt responsibility lies with the ESE General Receiving personnel and the ESE Chemistry Division Sample Custodian. During normal working hours, samples are received by ESE General Receiving, who then deliver the sample packages unopened to the laboratory. On weekends, sample packages are received at the ESE Mail Room. The ESE Sample Custodian or appropriate Lab Coordinator transfers them (unopened) to the laboratory.

#### 3.1.2 DELIVERY BY ESE FIELD PERSONNEL

Receipt responsibility lies with the Field Personnel who must also transport the sample packages unopened to the laboratory.

## 3.2 SAMPLE PACKAGE REVIEW AND LOGIN

The sample package deliverer enters the date and time of delivery to the laboratory, the number of physical packages, the project coordinator or addressee, and any comments including visible or suspected physical condition of the packages into the Sample Chest Custody Logbook (Exhibit B). Comments requiring more space than the logbook format allows may be continued on the page's reverse side. This entry is signed by the deliverer. During normal working hours, the deliverer places the packages on counters in the sample receiving area and leaves them there for further processing by the sample custodian. At other times, the deliverer places the packages in the coldroom after logbook entry. Specific sign-in procedures are posted at the coldroom.

## 3.3 SAMPLE CHEST UNPACKING, SAMPLE INTEGRITY, AND DOCUMENTATION REVIEW

### 3.3.1 CARTON RECEIPT DOCUMENTATION

Sample chests (packages) that have been transported to the sample receiving area in the laboratory are logged into the Sample Chest Custody book and then reviewed for integrity by the Sample Custodian. The chests are then recorded as being received by the laboratory in the Sample Chest Custody Logbook (see Exhibit B).

### 3.3.2 SAMPLE CHEST OPENING AND UNPACKING

Any sample chest known to contain or suspected of containing hazardous or toxic samples will be transported to a properly vented hood to be opened and unpacked employing protective measures.

Samples not expected to contain radioactive materials are handled as per SOP 4122-04, 3.3.4. Samples expected to contain radioactive materials are handled as per SOP 4122-04, 3.3.5.

All other sample chests are opened and unpacked in well ventilated, unencumbered areas provided in the sample receiving area, employing techniques described in the Chemistry Laboratory Safety Manual.

When sample fractions are unpacked, they are arranged in a logical order corresponding to field logsheet/chain-of-custody documentation that was received with the sample chest (see Exhibit C).

### 3.3.3 SAMPLE INTEGRITY AND DOCUMENTATION REVIEW

The sample custodian reviews the integrity of all sample fraction containers, as well as, the accuracy and clarity of all documentation received. All insufficiencies and/or discrepancies are recorded on the logsheet and reported to the appropriate laboratory project coordinator immediately. The Sample Custodian audits a portion of all fractions requiring field preservation to assure that they have been properly preserved. The Custodian will preserve unpreserved fractions upon receipt. All deficiencies in sample preservation are made known to the Laboratory Project Coordinator; all inadequacies are recorded on the logsheet and reported to the Laboratory Project Coordinator. After it has been determined that a sample has been received intact, in proper condition, properly preserved, and with necessary and accurate documentation, the Sample Custodian signs the logsheet. Any marks or notes made on the chain of custody document by the Custodian should be clearly distinguished from original field notations.

### 3.3.4 HANDLING PROCEDURES WHEN SAMPLES ARE NOT SUSPECTED TO CONTAIN MATERIAL HAVING RADIOACTIVE EMISSIONS IN EXCESS OF BACKGROUND EMISSIONS

All sample shipments delivered to the Sample Receipt Area are checked for radioactivity prior to acceptance. A survey shall be made for alpha, beta and gamma activity with a G-M Survey Meter and recorded in the package survey log.

If the shipment is found to contain material having radioactive emissions in excess of background emissions, the Radiation Safety Office (RSO) is immediately notified and the package is transferred to the radiochemistry laboratory sample receipt and log-in area. The "SOP for Sample Screening when samples are suspected to contain material having radioactive emissions in excess of background emissions" is now followed for this shipment.

If the shipment does not contain material having radioactive emissions in excess of background emissions, the package is opened and each sample surveyed for alpha, beta and gamma activity with a G-M Survey Meter and the results of the survey recorded in the sample survey log. Samples below 0.5 mRem/hr will follow standard log-in and storage procedures. If, however, samples are found to have levels in excess of 0.5 mRem/hour, the RSO is notified before any further action is taken. The RSO assesses the situation to determine if the samples may be analyzed or if the samples must be repackaged and returned to their point of origin. If the RSO determines that the samples may be analyzed, they are first transferred to the Radiochemistry Laboratory sample receipt and log-in area.

If it is determined by the RSO that a sample contains radioactivity above acceptable levels (1 mRem/hr), the appropriate Laboratory Coordinator and Section Manager are notified to determine with the RSO the disposition of the samples. Samples will be stored within the Radiochemistry Sample Storage Area during this period.

**3.3.5 HANDLING PROCEDURES WHEN SAMPLES ARE SUSPECTED TO CONTAIN MATERIAL HAVING RADIOACTIVE EMISSIONS IN EXCESS OF BACKGROUND EMISSIONS**

These shipments are delivered to the Radiochemistry Laboratory sample receipt and log-in area. A survey is then performed for alpha, beta and gamma activity with a G-M Survey Meter and recorded in the package

survey log. This survey determines whether any sample containers have been ruptured and/or the packing materials contaminated. If the levels exceed 0.5 mRem/hr, the RSO shall be notified immediately to assess the situation. Upon initial determination of safe external activities (less than 0.5 mRem/hr), the package is opened in a hood and each sample surveyed for alpha, beta and gamma activity with a G-M Survey Meter and the results of the survey recorded in the sample survey log. This log is maintained by the Radiochemistry Department. The unused portion of the samples will be stored within the Radiochemistry Sample Storage Area during sample preparation and analysis.

After analyses have been completed, any remaining sample material shall be disposed by either dilution of low level materials into the Low Level Radiochemistry Waste Barrel or by internment in the Hazardous Materials Shed for samples with activities above 2 mRem/hr for later disposal by a commercial waste handling corporation.

3.4 SAMPLE LOG-IN AND SAMPLE FRACTION DISTRIBUTION AND STORAGE

The Sample Custodian submits the original signed logsheet to Data Management and a photocopy to the Laboratory Project Coordinator. Freight-slips are attached to the original logsheet for filing.

The sample identification, analytical requirements, and all project information are entered into the computer system by Data Management personnel in accordance with the Computer Sample Log-in/Sample Arrival Notice SOP 4151-03. This process initiates the sample holding time tracking systems, available number systems, and sample arrival notice system.

An example of computer-generated sample arrival notices is presented in Exhibit D-1. Manually generated sample arrival notices are required for all short-holding-time sample fractions; an example is presented in Exhibit D-2.

Sample Fraction Distribution and Storage

The Sample Custodian distributes sample fractions as presented below:

| Sample Fraction | Delivered to | Documented On |
|---|---|---|
| R | Radiochem Laboratory | DFRS |
| V, VP (GC) | Volatiles-GC Laboratory | DFRS |
| V, VP (GCMS) | GCMS Laboratory | DFRS |
| Fast turnaround/SHT | Appropriate Laboratory | MGSAN |
| All Other Fractions | Cold Room | CRSAL |

Note: DFRS - Departmental Fraction Receipt Sheet
MGSAN - Manually Generated Sample Arrival Notice
CRSAL - Cold Room Sample Arrival Logbook
SHT - Short Holding Time

All fractions delivered to the specific laboratories must be logged into the Departmental Fraction Receipt Sheets by the Sample Custodian (see Exhibit E). All fractions placed in the coldroom must be logged on the coldroom sample arrival logsheet (see Exhibit F). All fractions removed and returned by analysts are to be documented on check-in/check-out logs (Exhibits G and H).

Delivery and Storage in the Radiochemistry Department

At the Radiochemistry Department, samples are delivered with arrival notices and chain of custody sheets to the Department Manager or the analyst on duty. Samples are then logged into the radiochemistry sample log book and are stored inside the padlocked storage room located in the radiochemistry wet lab trailer.

When samples are to be analyzed they are checked in and out of the storage room and logged on the Radiochemistry Storage and Custody log book located on the storage room door (see Exhibit I.).

After all analyses have been performed on the samples and the data has been delivered to the client, the samples are retained in the storage room for an interim period of one month. After this period has passed, the samples are either returned to the client (if requested) or turned over to the Hazardous Waste department for proper disposal. The samples transferred to Hazardous Waste are classified as Low Level or High Level radioactive waste by the radiochemistry department, prior to their transfer. Based upon the level of radioactivity present (Low Level Waste or High Level Waste), the samples are disposed of in proper NRC/Florida DHRS regulated manner.

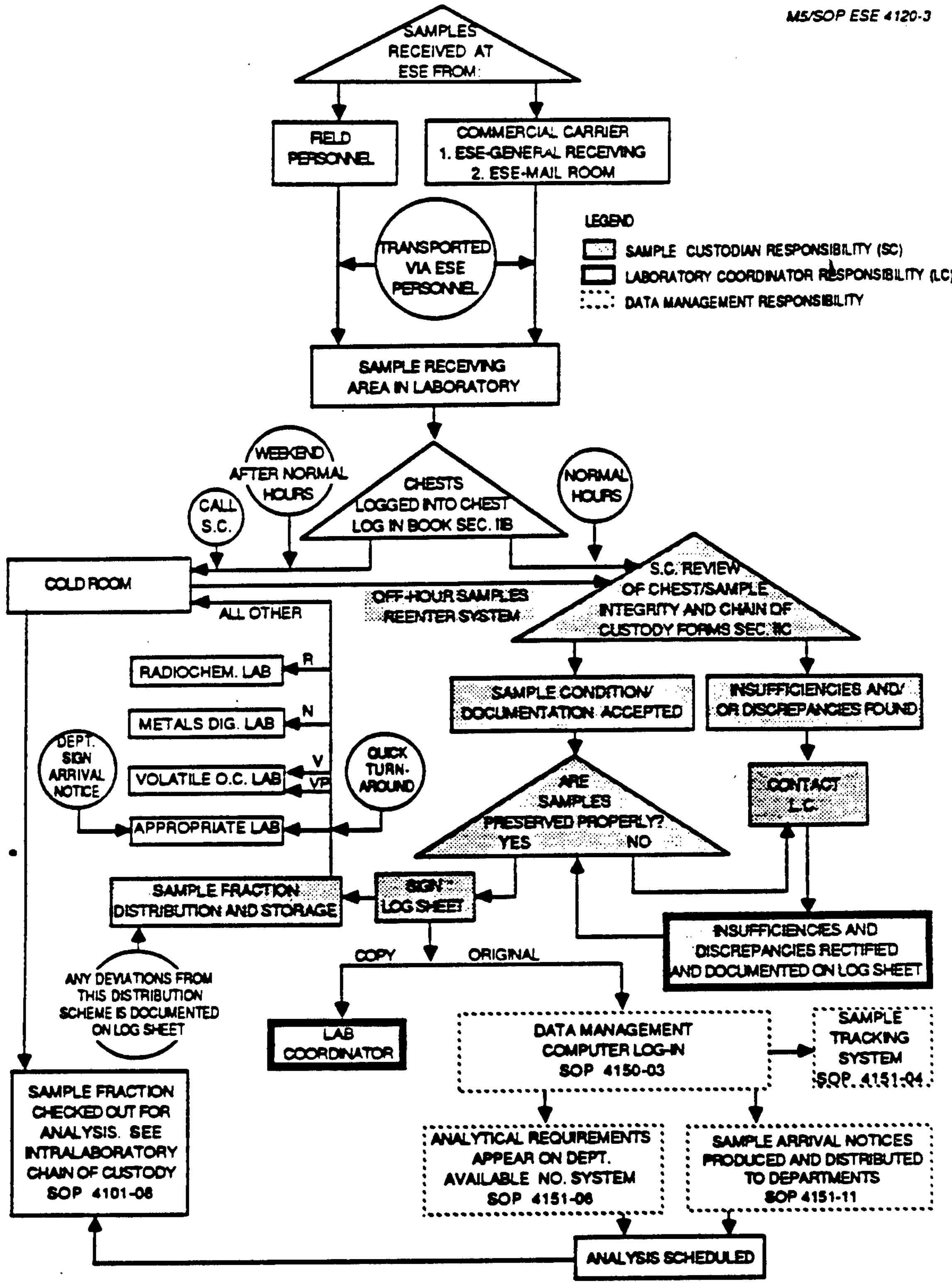


**Exhibit A**
**SAMPLE RECEIPT, LOG-IN, AND DISTRIBUTION FLOW CHART (SOP #4122-04)**

SOURCE: ESE, 1987.

**ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.**

SAMPLE CHEST CUSTODY FORM

**DO NOT REMOVE FROM CHECK-IN AREA**

| Relinquished By: | | | | |
|---|---|---|---|---|
| Time | Date | Signature | No. of Chests | Coordinator |
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| Received By: | | | | | | |
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| Date | Time | Project Name | Signature | Comments * | Rads>Background | |
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* No comment means that the container was relinquished/received in good condition, properly sealed and that there was no evidence of tampering.

CHEST(12/11/89)

EXHIBIT B

ENVIRONMENTAL SCIENCE & ENGINEERING 01-20-87 *** FIELD LOGSHEET *** FIELD GROUP: FTA2W
PROJECT NUMBER 87424 0000 PROJECT NAME: CAPE CANAVERAL LAB COORD. DAVE KNOTHE

| ESE # | SITE/STA | HAZ? | FTA2W FRACTIONS(CIRCLE) | DATE | TIME | PARAMETER LIST | H2O TEMP C | FIELD PH STD UNITS | SP COND UMHOS/CM |
|---|---|---|---|---|---|---|---|---|---|
| *1 | CCFTA2-1 | | N O VP W V V V VP VP VP | 25Feb87 | 1125 | CAPEW8 | 23.9 | 6.9 | 1232 |
| *2 | CCFTA2-2 | | N O VP W V V V VP VP VP | | 1248 | CAPEW8 | 23.4 | 6.9 | 1429 |
| *3 | CCFTA2-3 | | N O VP W V V V VP VP VP | | 1405 | CAPEW8 | 25.3 | 7.7 | 2640 |
| *4 | CCFTA2-4 | | N O VP W V V V VP VP VP | | 1430 | CAPEW8 | 24.4 | 7.3 | 1170 |
| *5 | CCFTA2-5 | | N O VP W V V V VP VP VP | | 1325 | CAPEW8 | 24.5 | 7.0 | 2100 |
| *6 | CCFTA2-6 | ~~HK~~ | N O VP W V V V VP VP VP | | 1215 | CAPEW8 | 25.2 | 6.7 | 1281 |
| *7 | CCFTA2-DUP | | N O VP W V V V VP VP VP | | — | CAPEW8 | — | — | — |
| *8 | BLANK | | N O VP W V V V VP VP VP | | | CAPEW8 | | | |

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I-IGNITABLE C-CORROSIVE R-REACTIVE T-TOXIC WASTE H-OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN LOGSHEETS WITH SAMPLES TO ESE

| | RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME) | RECEIVED BY (NAME/ORGANIZATION/DATE/TIME) |
|---|---|---|
| 1 | Robert Bush /ESE/25Feb87/1800 | McStizzl ESE 2/26/87 10: |
| 2 | | |
| 3 | | |

OTHER FIELD NOTES FOR FIELD GROUP FTA2W:

FTA2-6 — Hydrocarbons - free product - caution!!!

EXHIBIT C.

ENVIRONMENTAL SCIENCE & ENGINEERING 08/26/87 STATUS: PAGE# 1

# *** SAMPLE ARRIVAL NOTICE FOR DEPARTMENT 4133 ***

PROJECT NUMBER 87846 0100 PROJECT NAME CHEM SUPP 87830
FIELD GROUP NW CARBIDE PROJECT MANAGER JFG
LAB COORDINATOR JOHN GEMOULES
COLLECTION DATES: 08/20/87, 08/19/87
DUE DATES : DATE NOT SPECIFIED
TURNAROUND MATRIX : NONE SPEC'D DET. LIMIT SPEC'D : NONE SPECIFIED
QC : SAMPLE FRACTIONS
COMMENTS/QC FR:

SAMPLE SEQ #

| | | | DET.LMT. 11111111 1 CRITERIA 67890123456712345S |
|---|---|---|---|
| ARSENIC,DISS | ,UG/L | 1000=GFAA | NNNNNNNNNNGONNNNNO |
| BARIUM,DISS | ,UG/L | 1005=ICAP | NNNNNNNNNNOONNNNNO |
| CADMIUM,DISS | ,UG/L | 1025=ICAP | NNNNNNNNNNOONNNNNO |
| CHROMIUM,DISS | ,UG/L | 1030=ICAP | NNNNNNNNNNOONNNNNO |
| LEAD,DISS | ,UG/L | 1049=ICAP | NNNNNNNNNNOONNNNNO |
| MERCURY,DISS. | ,UG/L | 71890=CVAA | NNNNNNNNNNOONNNNNO |
| SELENIUM,DISS | ,UG/L | 1145=GFAA | NNNNNNNNNNOONNNNNO |
| SILVER,DISS | ,UG/L | 1075=ICAP | NNNNNNNNNNOONNNNNO |

O=OPEN L=IN LAB E=EXTRACTED N=NOT REQUESTED D=DONE S=SCHEDULED

EXHIBIT D-1.

EXHIBIT D-2.

ESE. ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.

## SAMPLE ARRIVAL NOTICE

TO: ______________________________ DATE: ______________

FROM: ______________________________

PROJECT NAME: ______________________________

PROJECT NO.: ______________________________

**PLEASE NOTE THAT THE FOLLOWING SAMPLES HAVE BEEN CHECKED IN:**

| FIELD GROUP | SAMPLE SEQUENCE NO. | MATRIX | COLLECTION DATE/TIME | ARRIVAL DATE | PARAMETER REQUESTED |
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WHITE COPY DEPARTMENT MANAGER YELLOW COPY COORDINATOR

FORM [illegible]

HUNTER/ESE DL... SAMPLE RECEIPT-LOG

| PROJECT COORDINATOR | PROJECT NAME | FIELD GROUP | SAMPLE SEQUENCE | ARRIVAL DATE | DELIVERED BY: | RECEIVED BY: | PRE-LOG ARR. NOTICE? |
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JDS2(11-28-88)

# ESE VOA GC/MS SAMPLE THRU - LOG

WEEK ENDING___________

| Project Coordinator | Samples & Description | Arrival Date | Checked in by | Screen Date | Analysis Date | Complaints | Comments<br>VOA Screen Requested |
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# ESE VOA GC SAMPLE THRU - LOG

WEEK ENDING__________

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EXHIBIT F.

COLD ROOM SAMPLE ARRIVAL LOGBOOK

**DO NOT REMOVE FROM COLD ROOM**

| Date | Time | Project Name or Field Group | No. Containers or Sample Nos. | Coordinator or Fractions | Signature | Comments |
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## SAMPLE CHECK IN/OUT LOG

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ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
P.O. BOX ESE
GAINESVILLE, FL. 32602
(904) 332-3318

ORGANICS

CONTRACT LABORATORY PROGRAM
SAMPLE CONTROL RECORD
CASE # ____________

ORGANICS

| EPA SAMPLE NUMBER | DATE & TIME REMOVED | REMOVED BY | FRACTION | REASON AND DESTINATION | DATE & TIME RETURNED |
|---|---|---|---|---|---|
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ESE
P.O. Box 1703
Gainesville, Fl. 32602

Exhibit I

# Radiochemistry
# Sample Storage and Custody
# Log Sheet

| Field Group | Sample Number | Delivery Date / Time | Check Out | Check In | Purpose of Removal |
|---|---|---|---|---|---|
| | | | Time / Date | Time / Date | |
| | | | Analyst | Analyst | |
| | | | Time / Date | Time / Date | |
| | | | Analyst | Analyst | |
| | | | Time / Date | Time / Date | |
| | | | Analyst | Analyst | |
| | | | Time / Date | Time / Date | |
| | | | Analyst | Analyst | |
| | | | Time / Date | Time / Date | |
| | | | Analyst | Analyst | |
| | | | Time / Date | Time / Date | |
| | | | Analyst | Analyst | |
| | | | Time / Date | Time / Date | |
| | | | Analyst | Analyst | |
| | | | Time / Date | Time / Date | |
| | | | Analyst | Analyst | |
| | | | Time / Date | Time / Date | |
| | | | Analyst | Analyst | |
| | | | Time / Date | Time / Date | |
| | | | Analyst | Analyst | |
| | | | Time / Date | Time / Date | |
| | | | Analyst | Analyst | |

SAMPLE STORAGE ORGANIZATION

STANDARD OPERATING PROCEDURE

SOP 4123-01

This Standard Operating Procedure (SOP) describes how ESE stores samples in coldrooms.

DATE: 9/16/87 AUTHORIZED BY: John J. Mousa

DISTRIBUTION:

C.3

Sample Storage Organization
SOP 4123-01

# SAMPLE STORAGE ORGANIZATION

## SOP 4123-01

## 1.0 ABSTRACT

This Standard Operating Procedure (SOP) describes how ESE stores samples in coldrooms.

## 2.0 PROCEDURE

Assign shelf space for each fraction and place the samples on the assigned shelves. Enter the shelf assignments into the CLASS computer network by logging into CONTROL (see SOP for CONTROL) and choosing coldroom management from the miscellaneous menu (#9). Produce a sample location report from the coldroom menu and post a copy on the coldroom door. When samples are thrown away, the coldroom technician will delete them from the location report.

# COLDROOM STORAGE QUALITY CONTROL
# STANDARD OPERATING PROCEDURE
# SOP 4123-02

This Standard Operating Procedure (SOP) describes ESE's coldroom quality control.

DATE: 11/6/89 AUTHORIZED BY: John J. Mason

DISTRIBUTION:

C.4

Coldroom Storage Quality Control
SOP 4123-02

# COLDROOM STORAGE QUALITY CONTROL
# STANDARD OPERATING PROCEDURE
# SOP 4123-02

## 1.0 ABSTRACT

This Standard Operating Procedure (SOP) describes ESE's coldroom quality control.

## 2.0 PROCEDURE

The coldroom will be locked with a combination lock at all times unless someone is inside. The combination will be known by chemistry personnel only. A sign-out sheet will be posted outside the coldroom, and anyone removing samples will list the samples removed from the coldroom (or returned) along with the person's name and date. The coldroom's interior temperature will be read each morning. The temperature will be recorded in the coldroom temperature book. If the temperature deviates from 4 degrees Celsius (°C) by more than ± 2°C, the maintenance department will be immediately notified to repair the cooling system.

EXHIBIT E

DEPARTMENT FRACTION-RECEIPT LOG SHEETS

(See SOP 4101-08)

C.5

Preventative Maintenance
SOP 4101-05

# PREVENTIVE MAINTENANCE
# STANDARD OPERATING PROCEDURE
# SOP 4101-05

This Standard Operating Procedure (SOP) describes how the ESE Chemistry Division regularly services its analytical instrumentation to help prevent data error or instrument failure.

DATE: 9/16/87 AUTHORIZED BY: John J. Mawn

DISTRIBUTION:

# PREVENTIVE MAINTENANCE
# SOP 4101-05

## 1.0 ABSTRACT

This Standard Operating Procedure (SOP) describes how the ESE Chemistry Division regularly services its analytical instrumentation to help prevent data error or instrument failure.

## 2.0 PROCEDURES

To minimize the occurrence of instrument failure and other system malfunction, the ESE Chemistry Division conducts a preventive maintenance program for field and laboratory instruments. Preventive maintenance performed for major pieces of field and analytical equipment is listed below.

### 2.1 YSI-SCT METER AND PROBE

Preventive maintenance protocol involves red-lining the meter to check the condition of the batteries. Probe preventive maintenance involves verifying temperature readings using a mercury thermometer and verifying that the probe does not need cleaning. A fouled probe is discovered by measuring a standard on the X100 and X10 ranges, then depressing the CELL TEST button. If the meter reading falls more than 2 percent, the probe is fouled and will be cleaned. Replacement membranes will be kept onsite.

### 2.2 pH METERS AND COMBINATION pH ELECTRODES

Preventive maintenance for the pH meter and electrodes primarily involves the proper care of the electrode. Electrodes are stored in a 1:1 solution of pH 7 buffer and deionized water. The hole used to add internal filling solution must be plugged at all times to prevent evaporation of the solution when the electrode is not in use. When the internal filling solution has dried out, the chamber will be rinsed with

deionized water before replacing the filling solution. This step prevents clogging of the probe and poor (<100 percent) slope adjustments when calibrating the electrode. Whenever slope readings deteriorate or a low ionic strength sample gives erroneous readings, the electrode will be treated with 1N KOH and 1N HCl.

Spare parts such as a replacement probe and fresh buffer solutions will be available for the system at all times.

## 2.3 BECKMAN CONDUCTIVITY BRIDGE AND CELL

Maintain the conductivity bridge by keeping the rechargeable battery fully charged. Store the conductivity cell in deionized water. Replatinization of the conductivity cell is performed according to Standard Methods (p. 74) only when the cell response becomes erratic, when a sharp end point cannot be obtained, or when any of the platinum black appears to have flaked off.

## 2.4 YSI DISSOLVED OXYGEN METER AND PROBE

Preventive maintenance procedures for the meter involves verifying that the mechanical zero is properly set and ensuring that the batteries are fully charged to red-line the instrument. The meter is shipped to the manufacturer for repair if any other problems exist. The Model 5420 BOD probe and the Model 5418 and 5419 probes are kept ready by storing in a moist atmosphere. Probe temperature readings are verified by comparison to the readings on a mercury thermometer. The DO Probe membrane is replaced before using the instrument in the field. The membrane must be replaced at least 24 hours before use to ensure stable readings during a large number of DO analyses. Probe replacement is necessary when the probe will not calibrate properly or when there are air bubbles under the membrane. Spare parts will be available for system components most likely to experience failure.

2.5 GC

Gas chromatograph (GC) septa will be replaced weekly, or more frequently when symptoms of septum deterioration are noted. Frequent injections will require daily replacement. To prevent contaminants from reaching the detector or columns, carrier and detector gases will be changed when cylinder pressure falls below 100 psi. Molecular sieves and oxygen traps used in the gas lines will be replaced regularly. GC detectors will be removed and cleaned periodically to remove accumulations which can affect instrument performance. Instrument calibration curves will be monitored and compared to historical performance. Excessive noise, low response, and poor precision indicate a dirty detector and probably require detector cleaning. Spare columns, packing materials, instrument cables, and some PC boards will be available to minimize instrument downtime.

2.6 GC/MS

All routine preventive maintenance performed for gas chromatograph also will be performed for the gas chromatograph/mass spectrophotometers (GC/MS). In addition, the ionizing source will be periodically dismantled, thoroughly cleaned, and reassembled to prevent serious sensitivity problems. Calibration with selected mass standards will be performed daily to ensure that instrument performance has not deteriorated. Failure to achieve calibration will require source cleaning. Spare parts and equipment will be available for the system components most likely to fail. Routine maintenance by the manufacturers' representatives will be performed annually.

2.7 ANALYTICAL BALANCE

Analytical balances will be cleaned and calibrated semiannually by manufacturers' representatives. Balance accuracy will be checked daily using standard weights. The balance logbooks will be maintained daily.

2.8 ICAP

Routine maintenance of the inductively coupled argon plasma (ICAP) system by the manufacturer's representatives will be performed annually. In addition, a quarterly service contract will be maintained on the supporting minicomputer. Periodically, the analyst will dismantle, clean, and reassemble the torch and nebulizer to prevent serious sensitivity problems. Calibration with selected standards will be performed daily to ensure that instrument performance has not deteriorated. Failure to achieve standardization could require cleaning, including changing the tubing of the sample delivery system. Spare parts will be available for the system components most likely to fail.

2.9 AAS

Routine preventive maintenance on the atomic absorption spectrophotometry (AAS) primarily consists of keeping components clean (to prevent acid corrosion), replacement of expendables, and monitoring instrument response. Instrumental response is compared to historical data and the manufactures' performance specifications to verify instrument sensitivity. Sample cells (e.g., graphite furnace, hydride cell, and burner/spray chamber) will be cleaned periodically to prevent serious contamination. Sufficient stock of spare parts and expendables will be kept to ensure continuous operation. Manufacturers' service representatives will inspect instrument optics and other components at least once per year.

2.10 HPLC

The high-pressure liquid chromatograph (HPLC) check values will be replaced every 6 months, and pump seals will be replaced as needed (usually annually). Pumps will be tested for flow rate accuracy monthly. Analytical columns will generally be protected by use of 3 to 5 cm pellicular guard columns.

# APPENDIX D

## Example SOPs for reports and Comparison with CLP

Table of Contents

Appendix D

D.1

Example of
Delivery Order Report
Format

DOCUMENT INVENTORY FOR:

____________________________

ESE (contract lab.)

ENCLOSED ARE THE FOLLOWING ITEMS IN ORDER OF APPEARANCE:

| | | NO. OF PAGES |
|---|---|---|
| 1) | EXPLANATION PACKET OF THE ITEMS BELOW. | ______ |
| 2) | DELIVERY ORDER/S: | |
| | A) ______ | ______ |
| | B) ______ | ______ |
| | C) ______ | ______ |
| | D) ______ | ______ |
| | E) ______ | ______ |
| 3) | SAMPLE ARRIVAL/ CUSTODY FORMS; | ______ |
| 4) | ANALYSIS REPORT (ESE FORMAT); | ______ |
| 5) | BATCH REPORT; | ______ |
| 6) | LOT REPORT; | ______ |
| 7) | LOT SUMMARY (LOT, TYPE OF ANALYSIS, SAMPLES IN LOT, ETC.); | ______ |
| 8) | CHEMICAL SUMMARY REPORT; | ______ |
| 9) | COMMUNICATION (DISPOSITION LETTERS, ETC.); | ______ |
| 10) | LOTS IN REPORT; NO. OF LOT FOLDERS | ______ |

COMMENTS:

# OUTLINE AND EXPLANATION OF THE LOGSHEET

The following form is a copy of the Field Logsheet, which serves as the chain-of-custody form between the field team and the receiving analytical laboratory.

1) The field group name is in bold at the top center of the form. Every field group name is unique and cannot be duplicated once established.

2) The numbers down the left hand side of the log sheet are the ESE sample sequence numbers for the unique field group.

3) The SITE/STATION I.D. is a site or location definition for that particular field group/ sample number combination. The site name is stored in the USATHAMA Data Management system with a associated map file. The site I.D. is to be defined prior to sampling to prevent mix ups of samples.

4) The FRACTIONS is a quick list of the type of parameters and containers to be taken for that ESE sample number. (i.e. W for extractable organics, N for metals, VP for volatile organics)

5) The DATE and TIME is the date and time that the sample was taken.

6) The PARAMETER LIST is the list name of the compounds and elements that the sample is to be analyzed for.

7) The rest of the logsheet is for comments about the sample of field information.

ENVIRONMENTAL SCIENCE & ENGINEERING 10-27-87 *** FIELD LOGSHEET *** FIELD GROUP: TESTFG
PROJECT NUMBER 86434 0120 PROJECT NAME: TEST - NWS LAB COORD. LISA BARE

| ESE # (2) | SITE/STA (3) | HAZ? (4) | (1) TESTFG FRACTIONS(CIRCLE) | DATE (5) TIME | (6) PARAMETER LIST | (7) |
|---|---|---|---|---|---|---|
| *1 | WS-7 | | C W N TR UP V V V W W | | SITE8W | |
| *2 | WS-8 | | C W N TR UP V V V W W | | SITE8W | |
| *3 | WS-9 | | C W N TR UP V V V W W | | SITE8W | |
| *4 | WS-10 | | C W N TR UP V V V W W | | SITE8W | |
| *5 | WS-11 | | C W N TR UP V V V W W | | SITE8W | |
| *6 | SSL-1 | | C W N TR UP V V V W W | | SITE8W | |
| *7 | SSL-2 | | C W N TR UP V V V W W | | SITE8W | |
| *8 | WS-1 | | C W N TR UP V V V W W | | SITE8W | |
| *9 | WS-2 | | C W N TR UP V V V W W | | SITE8W | |
| *10 | WS-3 | | C W N T UP V V V W W | | SITE8W | |
| *11 | WS-4 | | C W N R UP V V V W W | | SITE8W | |
| *12 | NSL-1 | | C W N TR UP V V V W W | | SITE8W | |
| *13 | NSL-2 | | C W N TR UP V V V W W | | SITE8W | |
| *14 | NSL-3 | | C N TR UP V V V W W | | SITE8W | |

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I-IGNITABLE C-CORROSIVE R-REACTIVE T-TOXIC WASTE H-OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN LOGSHEETS WITH SAMPLES TO ESE

| | RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME) | RECEIVED BY (NAME/ORGANIZATION/DATE/TIME) |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |

OTHER F ) NOTES FOR FIELD GROUP TESTFG:

# OUTLINE AND EXPLANATION OF THE BATCH REPORT

The batch report is a listing of all the batches associated with the samples in a particular field group.

The batch for a particular sample analyte combination can be found by looking down the analyte column and across the sample row until the two intersect. At that junction is the batch number for that sample/ analyte combination.

Looking down the second column of the Lot Summary Report, one can find which Lot that batch and the raw data are in.

A minus sign before a number denotes manually inputted data and no batch is associated with that parameter/ analyte. (Note: This is most often common with field data.)

# USATHAMA LOT REPORT

The Lot Report is a quick cross reference of all the lots associated with the samples in a particular field group.

The lot for a specific sample and analyte combination can be found by looking down the analyte column and across the sample row until the two meet. At that junction is the lot for that sample/analyte combination.

# OUTLINE AND EXPLINATION
# OF THE LOT SUMMARY REPORT

The Lot Summary Report is a quick reference of which samples are in which lot or batch.

1) The first column is the Lot name or number, each is unique and not repeatable.
2) The second column (Batch) is the batch associated with the Lot.
3) The third column (Analysis) is the method name of the analysis done for the samples in the indicated batch or lot.
4) The Sample Date column is the earliest sampling data within that lot.
5) The fifth column (LEV1.ACT.) is the date that the data within the lot was sent to PRI through IRDMS.
6) The BATCH SAMP column is a list of all the ESE samples within the lot and batch.
7) The last column (SAMP.ID) are the station I.D.s for the respective samples.

# EXPLANATION OF THE
# CHEMICAL SUMMARY REPORT

The April 1988 version of the Chemical Summary Report is a USATHAMA Program with access given to ESE to generate the report from data sent to USATHAMA.

The data must have been loaded into the Army Record Check program or the Chemical Summary Report will not accept the data and print the report.

PRI receives uncorrected data through IRDMS, where the data is rounded to 3 significant figures and then calculated for % moisture, dilutions, and accuracy. The data is then rerounded to its three significant figures.

The report contains all the analytes and site I.D.s on a per sample format.

## LOTS IN REPORT

This is the bulk of the report. The number of lots are given in the inventory cover sheet and the lots are filed in order according to the Lot Summary Report.

The lots contain the following information:

a) Raw Data, including calibration data, dilution factors, calibration plots, raw data spectra and chromatograms, strip charts, quantitation reports, data printouts, digestion logs, and copies of laboratory notebooks/logbooks.

b) Sample tracking records between the extraction technician and the analyst.

c) Each lot has a tracking sheet at the front of the lot folder to track the lot folder from the analyst through the data management and review systems, until validation.

d) The data batch report incorporates the samples run in that batch, the parameters, the calibration curve, QC, and uncorrected final concentrations.

e) The validated batch report contains all that is in Sec. d, but the final concentrations have been corrected for percent moisture and dilutions.

f) The lot folder includes a random number report used in the QA review system.

g) The lot folder also includes a group-check report which confirms that all the sites in the field group have map records. This reports also checks the QC of the batch.

h) TRR is the transfer file so that the data are in an acceptable format to go to PRI.

# EXPLANATION OF THE COMMUNICATION SECTION

The Communication Section is made up of, but not limited to, disposition submittal and acceptance letters. This section includes any correspondence between USATHAMA and ESE regarding the samples and analysis of the installation in question.

# EXPLANATION OF THE ESE ANALYSIS REPORT

This report contains the concentrations for the analysis performed on the samples for the field group in question. The analysis report is set up with sample numbers on the left and analytes across the top. To find the concentration of an analyte for a particular sample, look down the analyte column and across the sample row until the two meet, at this junction is the concentration for that sample/ analyte combination.

The reports are set up by methods so that the data of one method is not intermixed with the data of another method.

As per the 1985 QC Plan, ESE does not round any of the results to three significant figures until all of the calculations for % moisture, dilutions and accuracy have been made. This systems differs from the army method of calculating data so some disagreements in some of the results may occur. (Please see the section on the Chemical Summary Report for a review of the army data handling method.)

# THE DOCUMENT INVENTORY FORM

The Document Inventory Form is a quick list of the contents of the report. The items are listed in order of appearance.

1) The Delivery Order Section lists the delivery orders and the number of pages for each delivery order associated with the particular field effort.
2) The comment section will list all the deviations within the report.

D.2

Lot Folder Organization

D.2.a Organics Packet format example

USATHAMA

TABLE OF CONTENTS - GC/MS METHODS

A. TRANSMITTAL DOCUMENTS (to be supplied by Information Services)

______1. Army Data Review Form

______2. IRDMS Transfer File

______3. Results of IRDMS Record and Group Check

B. ANALYST DOCUMENTS

______1. Method Summary (supplied by Info. Services)

______2. ESE Data Batch Report, with:
- a. Analyst Signature
- b. Computer Checklist
- c. Manual Checklist

______3. Completed Control Chart and Comment/Corrective Action Form

______4. Laboratory Chronicle:
- a. ESE GC/MS Instrument Logsheet
- b. Copies of CLP/Pesticides Calibration Standards Notebook Pages
- c. Extraction Data Sheet

______5. Chain-of-Custody and Possession Records
- a. Field Chain-of-Custody Sheets (supplied by Information Services)
- b. Laboratory Chain-of-Custody Sheets

______6. Initial Calibration Forms
- a. Five point Initial Calibration with RFS, RF and % RSD (Form VI)
- b. Quantitation Report, Total Ion Chromatograms and Spectral Comparison

______7. GC/MS Performance Tuning (Form V)

______8. Continuing Calibration Forms
- a. Beginning Run (50 ug/mL)
  - * Form VI - Daily RF, VS, Initial RF
  - * RF list used to Quantitate Targets Analyses
  - * Quantitation Report, Total Ion Chromatograms and Spectral Comparison
- b. End Run (50 ug/mL)
  - * Form VI - Daily RF, VS, Initial RF
  - * Quantitation Report, Total Ion Chromatograms and Spectral Comparison

______9. GC/MS Chromatograms and Spectral Data (for sample, matrix spikes and blank)
- a. Quantitation Reports, Total Ion Chromatograms and Spectral Comparison

_____10. One or two Examples of Calculations Performed

_____11. Pre-screen Raw Data (if applicable)

C. Appendix

1. Preliminary Data, Unused Data (if applicable)
2. ESE Review Files (QA and Lab Coordinator)
3. USATHAMA Review Files (QA and Lab Coordinator)

FINAL CHECKOFF LIST PRIOR TO TRANSMISSION OF USATHAMA LOT DATA

The following information should be contained in this USATHAMA Lot Folder prior to transferring custody of the folder to the Sample Control Center.

*********************************************************************

| NA* or check if present | | Required Information |
|---|---|---|
| ____ | ____ | Completed Control Chart or Comment/Corrective Action Form (if applicable) |
| ____ | ____ | Sample extraction date (if applicable) |
| ____ | ____ | Sample analysis date (with analysts initials) |
| ____ | ____ | Subsample chain-of-custody (Extraction/Digestion Data Sheet, etc.), if applicable. |
| ____ | ____ | All raw data (chromatograms - labelled, numbered, target peak identified.) |
| ____ | ____ | Analytical conditions |
| ____ | ____ | Calibration curve (concentration vs. response, correlation coefficient) |
| ____ | ____ | Responses (area counts, peak heights, etc.) of samples, spikes and standards. |
| ____ | ____ | Reduction sheets (if applicable) |
| ____ | ____ | Example of how calculations are performed |
| ____ | ____ | Final data |
| ____ | ____ | Copies of instrument log book pages |
| ____ | ____ | Copies of standard preparation log book pages |

______ ______ (INITIALS)
QA Staff    Analyst

______ ______ (DATE)

* NA = Not Applicable

COMMENT/CORRECTIVE ACTION FORM
USATHAMA CONTROL CHARTS

USATHAMA LOT ________ USATHAMA METHOD _______ DATE ANALYZED ________

COMMENTS PROVIDED BY ______________________________ DATE ___________

QC CHART SITUATIONS TO BE ADDRESSED:

* A value outside the control limits.
* A series of successive points on the same side of the central line.
* A series of successive points going in one direction.
* A cyclical representation of control values.
* Two consecutive points between the Warning and Control Limits.

COMMENTS: ____________________________________________

CORRECTIVE ACTIONS TAKEN: ____________________________________________

Reviewed By:

Group Leader/Department Mgr. ______________________ Date ________

Laboratory Coordinator ______________________ Date ________

Quality Assurance Coordinator ______________________ Date ________

Other (specify title/name) ______________________ Date ________

B.4.c



# EXTRACTION DATA SHEET



Project Name: ______________________
Project Number: ____________________
Analytical Method Number: ______________ Lot Number: ______________

| Sample Number | Fraction Used | Extraction Date | Extractor | Initial Volume (ml) or Initial Weight (g-wet) | Final Volume (ml) | Comments (Use Page 3 for more comments; include QC spike data--surrogate spike data.) |
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# EXTRACTION DATA SHEET
(Continued)



Project Name: ____________________
Project Number: ____________________
Analytical Method Number: ____________________ Lot Number: ____________________

| Sample Number | Date Extract Relinquished | Relinquished By | Received By | Date Extract Relinquished | Relinquished By | Received By | Date Extract Relinquished | Relinquished By | Received By | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
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EXTRACTION DATA SHEET
(Continued)



Project Name: ____________________
Project Number: ____________________
Analytical Method Number: ____________________ Lot Number: ____________________

| Sample Number | Additional Comments |
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B.5.a

***THE FIELD SAMPLE-CUSTODY FORMS FOR THE SAMPLES WITHIN THIS LOT ARE IN THE FRONT PORTION OF THE FINAL DELIVERY ORDER REPORT. SEE THE DOCUMENT INVENTORY FORM.***

| ***D.O.#*** | ***INSTALLATION*** |
|---|---|
| ______ | ________________ |

***NOTE:* SOME OF THE SAMPLES IN THIS LOT ARE FROM OTHER USATHAMA CONTRACTS. THE CUSTODY FORMS FOR THOSE SAMPLES ARE CURRENTLY AT ESE IN THEIR APPROPRIATE FIELDGROUP FILES. THE LOTS AND CHAIN-OF-CUSTODY FORMS FOR THAT CONTRACT WILL REMAIN AT ESE UNTIL SHIPMENT TO USATHAMA IS REQUESTED.**

| FIELDGROUP NAME | INSTALLATION |
| --- | --- |
| | |
| | |
| | |

***NOTE:*** ***SOME OF THE SAMPLES IN THIS LOT ARE FROM OTHER USATHAMA CLASS DELIVERY ORDERS. THE CUSTODY FORMS FOR THOSE SAMPLES ARE IN THEIR APPROPRIATE FINAL DELIVERY ORDER REPORTS. (SEE DOCUMENT INVENTORY FORM FOR THAT D.O. REPORT)***

***ESE FIELDGROUP NAMES FOR SAMPLES ASSOCIATED WITH THIS LOT ARE:***

| ***FIELDGROUP NAME*** | ***D.O. #*** | ***INSTALLATION*** |
|---|---|---|
| | | |
| | | |
| | | |

## D.2.b Inorganic Packet format example

LOT FOLDER ORGANIZATION - the following items will be numbered and placed in the lot folder in the order indicated:

## A. TRANSMITTAL DOCUMENTS (to be supplied by Information Services)

1. Army Data Review Form

2. IRDMS Transfer File

3. Results of IRDMS Record and Group Check

## B. ANALYST DOCUMENTS

1. Method Summary (supplied by Information Services)

2. ESE Data Batch Report, with:
   a. Analyst Signature
   b. Computer Checklist
   c. Manual Checklist
   d. Example Calculation

3. Completed Control Chart and Comment/Corrective Action Form

4. Copies of Instrument Logbook Pages with Analytical Conditions

5. Raw Data, with:
   a. Responses (emission/area counts, peak heights, etc.)
   b. Calibration Curve
   c. Changes made properly and initialed.

6. Copies of Sample Extraction/Preparation Logbook Pages

7. Chain-of-Custody and Possession Records
   a. Field Chain-of-Custody Sheets (supplied by Information Services)
   b. Laboratory Subsample Chain-of-Custody

## C. APPENDIX

1. Preliminary Data, Unused Data (if applicable)

2. Laboratory Coordinator and QA Review Files

3. Validation File in USATHAMA Format

# ARMY DATA REVIEW FORM

A.1

ARMY LOT ______________ INSTALLATION ______________

DATA BATCH ______________ METHOD ______________

REQUIRED LEVEL TWO DATE ______________

| | DUE DATE | INITIALS | DATE | COMMENTS |
|---|---|---|---|---|
| DATA COORDINATOR | | | | |
| GROUP LEADER | | | | |
| TASK MANAGER | | | | |
| DATA COORDINATOR | | | | |
| QA COORDINATOR DATA (VALIDATION COMPLETE) | | | | |
| (PACKET COMPLETE) | | | | |
| DATA COORDINATOR (FILE TRANSMITTED) | | | | |

COMMENTS :

______________________________________________

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# COMMENT/CORRECTIVE ACTION FORM
# USATHAMA CONTROL CHARTS

USATHAMA LOT ________ USATHAMA METHOD ______ DATE ANALYZED ________

COMMENTS PROVIDED BY ________________________________ DATE __________

QC CHART SITUATIONS TO BE ADDRESSED:

* A value outside the control limits.
* A series of successive points on the same side of the central line.
* A series of successive points going in one direction.
* A cyclical representation of control values.
* Two consecutive points between the Warning and Control Limits.

COMMENTS: ____________________________________________

CORRECTIVE ACTIONS TAKEN: ____________________________________

Reviewed By:

Group Leader/Department Mgr. ____________________ Date ________

Laboratory Coordinator ____________________ Date ________

Quality Assurance Coordinator ____________________ Date ________

Other (specify title/name) ____________________ Date ________

B.6

D-RMA.1/SAMPCON-EDS.1
12/07/84

# EXTRACTION DATA SHEET

Page _____ of _____

Project Name: ____________________
Project Number: ____________________
Analytical Method Number: ____________ Lot Number: ____________

| Sample Number | Fraction Used | Extraction Date | Extractor | Initial Volume (ml) or Initial Weight (g-wet) | Final Volume (ml) | Comments (Use Page 3 for more comments; include QC spike data--surrogate spike data.) |
|---|---|---|---|---|---|---|
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***THE FIELD SAMPLE-CUSTODY FORMS FOR THE SAMPLES WITHIN THIS LOT ARE IN THE FRONT PORTION OF THE FINAL DELIVERY ORDER REPORT. SEE THE DOCUMENT INVENTORY FORM.***

| ***D.O.#*** | ***INSTALLATION*** |
| --- | --- |
| ____ | ____________ |

***NOTE:*** ***SOME OF THE SAMPLES IN THIS LOT ARE FROM OTHER USATHAMA CONTRACTS. THE CUSTODY FORMS FOR THOSE SAMPLES ARE CURRENTLY AT ESE IN THEIR APPROPRIATE FIELDGROUP FILES. THE LOTS AND CHAIN-OF-CUSTODY FORMS FOR THAT CONTRACT WILL REMAIN AT ESE UNTIL SHIPMENT TO USATHAMA IS REQUESTED.***

| ***FIELDGROUP NAME*** | ***INSTALLATION*** |
|---|---|
| | |
| | |
| | |

B.7.a

***NOTE:*** ***SOME OF THE SAMPLES IN THIS LOT ARE FROM OTHER USATHAMA CLASS DELIVERY ORDERS. THE CUSTODY FORMS FOR THOSE SAMPLES ARE IN THEIR APPROPRIATE FINAL DELIVERY ORDER REPORTS. (SEE DOCUMENT INVENTORY FORM FOR THAT D.O. REPORT)***

***ESE FIELDGROUP NAMES FOR SAMPLES ASSOCIATED WITH THIS LOT ARE:***

| ***FIELDGROUP NAME*** | ***D.O. #*** | ***INSTALLATION*** |
|---|---|---|
| | | |
| | | |
| | | |

USATHAMA

TABLE OF CONTENTS - METALS

ARMY DATA REVIEW FORM

A.1

ARMY LOT ______________ INSTALLATION ______________

DATA BATCH ______________ METHOD ______________

REQUIRED LEVEL TWO DATE ______________

| | DUE DATE | INITIALS | DATE | COMMENTS |
|---|---|---|---|---|
| DATA COORDINATOR | | | | |
| GROUP LEADER | | | | |
| TASK MANAGER | | | | |
| DATA COORDINATOR | | | | |
| QA COORDINATOR DATA (VALIDATION COMPLETE) | | | | |
| ' KET COMPLETE) | | | | |
| DATA COORDINATOR (FILE TRANSMITTED) | | | | |

MMENTS :

B7.b

Page______ of______

## METALS SUBSAMPLE CHAIN-OF-CUSTODY

Project Name:______________________
Project Number:____________________
Analytical Method Number:__________

Lot Number:____________

| Sample Number | Fraction Used | Digestion Date | Digestor | Initial Volume (mL) or Weight (g-wet) | Final Volume (mL) | Comments |
|---|---|---|---|---|---|---|
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Page______ of______

METALS SUBSAMPLE CHAIN-OF-CUSTODY
(Continued)

Project Name:______________________
Project Number:____________________
Analytical Method Number:__________

Lot Number:_____________

| Sample Number | Date Digestate Relinquished | Relinquished By | Received By | Date Digestate Relinquished | Relinquished By | Received By | Comments |
|---|---|---|---|---|---|---|---|
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Digestate Custodian____________________

Page______ of______

METALS SUBSAMPLE CHAIN-OF-CUSTODY
(Continued)

Project Name:____________________
Project Number:__________________
Analytical Method Number:__________

Lot Number:____________

| Sample Number | Spiking Information/Additional Comments |
|---|---|
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D.3

Comparison of USATHAMA/CLP Data Packages

## D.3.a Comparison of Document Inventories

CONTRACT LAB (SOW 788) DOCUMENT INVENTORY

1. Chain File Document Inventory Sheet
2. Chain-of-Custody Records
3. Shipping Manifests
4. Sample Tags
5. SMO Inorganics/Organics Traffic Reports
6. Inorganics Analysis Data Summary Sheets
7. Analysts' Notebook Pages
8. Instrument Logbook Pages

DOCUMENT INVENTORY FOR:

______________________

ESE (contract lab.)

ENCLOSED ARE THE FOLLOWING ITEMS IN ORDER OF APPEARANCE:

| | | NO. OF PAGES |
|---|---|---|
| 1) | EXPLANATION PACKET OF THE ITEMS BELOW. | ______ |
| 2) | DELIVERY ORDER/S: | |
| | A) ________ | ______ |
| | B) ________ | ______ |
| | C) ________ | ______ |
| | D) ________ | ______ |
| | E) ________ | ______ |
| 3) | SAMPLE ARRIVAL/ CUSTODY FORMS; | ______ |
| 4) | ANALYSIS REPORT (ESE FORMAT); | ______ |
| 5) | BATCH REPORT; | ______ |
| 6) | LOT REPORT; | ______ |
| 7) | LOT SUMMARY (LOT, TYPE OF ANALYSIS, SAMPLES IN LOT, ETC.); | ______ |
| 8) | CHEMICAL SUMMARY REPORT; | ______ |
| 9) | COMMUNICATION (DISPOSITION LETTERS, ETC.); | ______ |
| 10) | LOTS IN REPORT; NO. OF LOT FOLDERS | ______ |

COMMENTS:

## D.3.b Organic Data Packages comparison

USATHAMA

TABLE OF CONTENTS - GC/MS METHODS

USATHAMA & EPA

ORGANIC DATA PACKAGE COMPARISON

The same basic information is contained in both data packages. The main differences are in format and presentation of various specific information.

EPA organic packages contain all volatiles, BNA and pesticide/PCB results in one package. In contrast, USATHAMA packages are grouped by method and each package contains all custody and supporting information for that method.

Presentation of quality control data is another major difference. In EPA packages, all QC data are tabulated and presented on forms in Section III and VI of the data package. Control Charts (submitted weekly) are USATHAMA's method of presenting and reporting QC data.

Attached are basic outlines of EPA and USATHAMA data packages. A list of EPA-CLP form descriptions is cross referenced to show where each item is contained in the USATHAMA package.

CONTRACT LAB (SOW 788) FORM DESCRIPTIONS

1. CASE NARRATIVE

2. TRAFFIC REPORTS

3. VOLATILES DATA

| | | |
|---|---|---|
| A. QC Summary | | |
| 1) Surrogate % Recovery Summary | (FORM II) | B.2 |
| 2) MS/MSD Summary | (FORM III) | NA |
| 3) Method Blank Summary | (FORM IV-VOA) | B.2 |
| 4) GC/MS Tuning/Mass Calibration | (FORM V) | B.7 |
| B. Sample Data (arranged in packets in increasing EPA Sample Number) | | |
| 1) TCL Results - Analysis Data Sheet | (FORM I) | B.2 |
| 2) Tentatively Identified Compounds | (FORM I-TIC) | TIC Lot Folder |
| 3) Reconstructed Total Ion Chromatogram | | B.9 |
| 4) Raw Data | | |
| a) Copies of raw spectra and background substance mass spectra of target compounds | | |
| b) Copies of mass spectra of tentatively identified compounds with associated best match spectra | | |
| C. Standard Data | | |
| 1) Initial Calibration Data | (FORM VI) | B.6 |
| a) Standard reconstruction chromatograms and quantitation reports for initial calibration | (5-point) | |
| 2) Continuing Calibration | (FORM VIII) | B.8 |
| a) Reconstructed ion chromatograms and quantitation reports | | |
| 3) Internal Standard Area Summary | (FORM VIII) | B.9 |
| D. Raw QC Data | | |
| 1) BFB or DFTPP with Bar graph Spectrum and Mass Listing | | B.7 |
| 2) Blank Data | | |
| a) Tabulated results | (FORM I) | B.2 |
| b) Tentatively identified compounds | (FORM I-TIC) | |
| c) Reconstructed ion chromatograms and quantitation reports | | |

| | | |
|---|---|---|
| d) TCL spectra with lab generated standard | | |
| e) GC/MS library search spectra for Tentatively Identified Compounds | | |
| f) Quatitation/Calculation of Tentatively Identified Compounds | | |
| 3) Matrix Spike Data | | |
| a) Tabulated results | (FORM I) | NA |
| b) Reconstructed ion chromatograms and quantitation reports | | Standard Control Spike |
| 4) Matrix Spike Duplicate Data | | B.2,B.9 |
| a) Tabulated results | (FORM I) | NA |
| b) Reconstructed ion chromatograms and quantitation reports | | |

4. SEMI-VOLATILES DATA

| | | |
|---|---|---|
| A. QC Summary | | |
| 1) Surrogate % Recovery Summary | (FORM II) | B.2 |
| 2) MS/MSD Summary | (FORM III) | NA |
| 3) Method Blank Summary | (FORM IV-VOA) | B.2 |
| 4) GC/MS Tuning/Mass Calibration | (FORM V) | B.7 |
| B. Sample Data (arranged in packets in increasing EPA Sample Number) | | |
| 1) TCL Results - Analysis Data Sheet | (FORM I) | B.2 |
| 2) Tentatively Identified Compounds | (FORM I-TIC) | TIC Lot Folder |
| 3) Reconstructed Total Ion Chromatogram | | B.9 |
| 4) Raw Data | | |
| a) Copies of raw spectra and background substance mass spectra of target compounds | | |
| b) Copies of mass spectra of tentatively identified compounds with associated best match spectra | | |
| C. Standard Data | | |
| 1) Initial Calibration Data | (FORM VI) | B.6 |
| a) Standard reconstruction chromatograms and quantitation reports for initial calibration | (5-point) | |
| 2) Continuing Calibration | (FORM VIII) | B.8 |
| a) Reconstructed ion chromatograms and quantitation reports | | |
| 3) Internal Standard Area Summary | (FORM VIII) | B.9 |
| D. Raw QC Data | | |
| 1) BFB or DFTPP with Bar graph Spectrum and Mass Listing | | B.7 |
| 2) Blank Data | | |
| a) Tabulated results | (FORM I) | B.2 |
| b) Tentatively identified compounds | (FORM I-TIC) | |
| c) Reconstructed ion chromatograms and quantitation reports | | |
| d) TCL spectra with lab generated standard | | |
| e) GC/MS library search spectra for Tentatively Identified Compounds | | |
| f) Quatitation/Calculation of Tentatively Identified Compounds | | |

| | | |
|---|---|---|
| 3) Matrix Spike Data | | |
| a) Tabulated results | (FORM I) | NA |
| b) Reconstructed ion chromatograms and quantitation reports | | Standard Control Spike |
| 4) Matrix Spike Duplicate Data | | B.2,B.9 |
| a) Tabulated results | (FORM I) | NA |
| b) Reconstructed ion chromatograms and quantitation reports | | |

5. PESTICIDE/PCB DATA (GC/ECD)

A. QC Summary

| | |
|---|---|
| 1) Surrogate % Recovery Summary | (FORM II) |
| 2) MS/MSD Summary | (FORM III) |
| 3) Method Blank Summary | (FORM IV) |

B. Sample Data (arranged in packets in increasing EPA Sample Number)

| | |
|---|---|
| 1) TCL Results - Analysis Data Sheet | (FORM I) |
| 2) Copies of chromatograms | |
| 3) Copies of chromatograms from 2nd column confirmation | |
| 4) Integration Reports | |
| 5) Manual Work Sheets | |
| 6) GPC chromatograms | |
| 7) GC/MS confirmation raw spectra and background subtracted mass spectra | |

C. Standard Data

| | |
|---|---|
| 1) Pesticide Evaluation Standards Summary | (FORM VIII) |
| 2) Pesticide/PCB Standards Summary | (FORM IX) |
| 3) Pesticide/PCB Identification for positive results | (FORM X) |
| 4) Standard chromatograms and data system printouts | |

D. Raw QC Data

1) Blank Data

| | |
|---|---|
| a) Tabulated results | (FORM I) |
| b) Chromatograms and data system printouts | |

2) Matrix Spike Data

| | |
|---|---|
| a) Tabulated results of non-spike TCL compounds | (FORM I) |
| b) Chromatograms and data system printouts | |

3) Matrix Spike Duplicate Data

| | |
|---|---|
| a) Tabulated results of non-spike TCL compounds | (FORM I) |
| b) Chromatograms and data system printouts | |

USATHAMA

TABLE OF CONTENTS - GC/MS METHODS

A. TRANSMITTAL DOCUMENTS (to be supplied by Information Services)

______1. Army Data Review Form

______2. IRDMS Transfer File

______3. Results of IRDMS Record and Group Check

B. ANALYST DOCUMENTS

______1. Method Summary (supplied by Info. Services)

______2. ESE Data Batch Report, with:
- a. Analyst Signature
- b. Computer Checklist
- c. Manual Checklist

______3. Completed Control Chart and Comment/Corrective Action Form

______4. Laboratory Chronicle:
- a. ESE GC/MS Instrument Logsheet
- b. Copies of CLP/Pesticides Calibration Standards Notebook Pages
- c. Extraction Data Sheet

______5. Chain-of-Custody and Possession Records
- a. Field Chain-of-Custody Sheets (supplied by Information Services)
- b. Laboratory Chain-of-Custody Sheets

______6. Initial Calibration Forms
- a. Five point Initial Calibration with RFS, RF and % RSD (Form VI)
- b. Quantitation Report, Total Ion Chromatograms and Spectral Comparison

______7. GC/MS Performance Tuning (Form V)

______8. Continuing Calibration Forms
- a. Beginning Run (50 ug/mL)
  - * Form VI - Daily RF, VS, Initial RF
  - * RF list used to Quantitate Targets Analyses
  - * Quantitation Report, Total Ion Chromatograms and Spectral Comparison
- b. End Run (50 ug/mL)
  - * Form VI - Daily RF, VS, Initial RF
  - * Quantitation Report, Total Ion Chromatograms and Spectral Comparison

______9. GC/MS Chromatograms and Spectral Data (for sample, matrix spikes and blank)
- a. Quantitation Reports, Total Ion Chromatograms and Spectral Comparison

_____10. One or two Examples of Calculations Performed

_____11. Pre-screen Raw Data (if applicable)

C. Appendix

1. Preliminary Data, Unused Data (if applicable)
2. ESE Review Files (QA and Lab Coordinator)
3. USATHAMA Review Files (QA and Lab Coordinator)

## D.3.c Inorganic Data Package Comparison

## USATHAMA & EPA

## INORGANIC DATA PACKAGE COMPARISON

The same basic information is contained in both data packages. The main differences are in format and presentation of various specific information.

EPA-CLP inorganic packages contain all metals and inorganic analytes in one package. In contrast, USATHAMA packages are grouped by method and each package contains all custody and supporting information for that method.

Presentation of quality control data is the other major difference. In EPA packages, all QC data are tabulated and presented on forms in Section I of the data package. Control Charts (submitted weekly) are USATHAMA's method of presenting and reporting QC data.

Attached are basic outlines of EPA-CLP and USATHAMA inorganic data packages. A list of the EPA-CLP form descriptions is cross referenced to show where each item is contained in the USATHAMA package.

CONTRACT LAB (SOW 788) FORM DESCRIPTIONS

| | | | |
|---|---|---|---|
| 1. | Cover Page - Inorganic Analyses Data Package<br>Lists all samples analyzed within a Sample Delivery Group and general comments. Signed by the Laboratory Manager. | [COVER PAGE-IN] | |
| 2. | Inorganic Analysis Data Sheet<br>Used to tabulate and report sample analysis results for target analytes. (One form for each sample) | [FORM 1-IN] | |
| 3. | Initial and Continuing Calibration Verification | [FORM II(PART 1)-IN] | B.2,B.5 |
| 4. | CRDL Standard for AA and ICP<br>Reports analyte recoveries from analyses of the CRDL standards for AA (CRA) and ICP (CRI). | [FORM II(PART 2)-IN] | NA |
| 5. | Blanks<br>Used to report ICB, CCB, PB. | [FORM III-IN] | B.2,B.5 |
| 6. | ICP Interference Check Sample | [FORM IV-IN] | B.2,B.5 |
| 7. | Spike Sample Recovery | [FORM V(PART 1)-IN] | B.3 |
| 8. | Post Digestion Spike Sample Recovery | [FORM V(PART 2)-IN] | NA |
| 9. | Duplicates | [FORM VI-IN] | B.3 |
| 10. | Laboratory Control Sample<br>Reports recoveries for solid and aqueous LCS (taken through digestion process). | [FORM VII-IN] | B.3 |
| 11. | Standard Addition Results (furnace) | [FORM VIII-IN] | NA |
| 12. | ICP Serial Dilution | [FORM IX-IN] | NA |
| 13. | Instrument Detection Limits (Quarterly) | [FORM X-IN] | B.1 |
| 14. | ICP Interelement Correction Factors (Annually) | [FORM XI(PART1)-IN] | |
| 15. | " " " " " | [FORM XI(PART2)-IN] | |

# CONTRACT LAB (SOW 788) DOCUMENT INVENTORY

1. Chain File Document Inventory Sheet
2. Chain-of-Custody Records
3. Shipping Manifests
4. Sample Tags
5. SMO Inorganics/Organics Traffic Reports
6. Inorganics Analysis Data Summary Sheets
7. Analysts' Notebook Pages
8. Instrument Logbook Pages

Lot No.:__________ **B1**

SUMMARY OF METHOD

| NUMBER | TITLE | QC REFERENCE |
|---|---|---|
| JD19 | Analysis of Arsenic in Soils by GFAA. | USATHAMA |

DIGESTION PROCEDURE:

1. Transfer a 1.0 g aliquot of well-mixed sample to a 150 mL beaker.

2. Prepare 1000 ug/L spike solution: transfer 10 mL of a 10 mg/L As solution to a 100 mL volumetric flask, add 10 mL conc. $HNO_3$ & dilute to volume.
   Give an aliquot of the spike solution to an ICAP operator for verification.

3. Prepare quality control samples:
   a. Method blank - a 0.1 g aliquot of standard sandy soil.
   b. Low spike - add 0.5 mL of the spiking solution to a 0.1 g aliquot of standard sandy soil. [target = 0.5 ug/g (5.0 ug/L)]
   c. High spikes - add 8.0 mL of the spiking solution to 2-0.1 g aliquots of standard sandy soil [target = 8.0 ug/g (80 ug/L)]

4. Add 10 mL (1+1) $HNO_3$ to all samples and QC. Cover with a watch glass and reflux for 10-15 minutes without boiling. Cool and add 5 mL conc. $HNO_3$. Cover and reflux for 30 min. Volume should not be reduced to less than 5 mL. Again add 5 mL conc. $HNO_3$ and reflux for 30 min. Cool. Add 2 mL type I water and 3 mL 30% $H_2O_2$. Cover and heat. Remove beaker from hot plate if effervescence is excessive. Heat until effervescence subsides. Cool and add 1 mL aliquots of $H_2O_2$ and heat until appearance is unchanged or effervescence is minimal. Do not add more than 10 mL $H_2O_2$. Cool, add 10 mL type I water and reflux for 15 min. without boiling. Cool, filter and adjust final volume to 100 mL with type I water.

   NOTES:

Signed __________ Date __________

INSTRUMENT ANALYSIS:

1. Instrument: 5100

2. Calibration curve: 100, 50, 25, 5.0, 2.5, 0.0 ug/L (linear). Prepare 100 and 10 ug/l standards for instrument dilution. Certified reporting limit = 0.25 ug/g (2.5 ug/L), upper certified limit = 10.0 ug/g (100 ug/L). Note: Standards should be 10% $HNO_3$.

3. Modifier: palladium nitrate + magnesium nitrate.

4. QC: analyze a reference at the beginning and end of the run and reanalyze the 100 ug/l standard after every 10 samples and at the end of the run. Recoveries must be ± 10%.

   NOTES:

Signed __________ Date __________

JD19 Method Summary cont.

ESE DATA ENTRY

1. Enter calibration standards (even if data is being reported in final concentration). Do not enter a detection limit - it will be supplied by Information Services.

2. If blank correction is being applied to the soil samples, an appropriate explanation must be supplied.

3. Enter a DA sample with the same field group as the method blank. If blank correction is being applied the "DA Blank" response should be twice the MB response. If the MB has a negative response or the response is less than the detection limit, enter the response as 0 Final.

4. Use 10X the actual standard soil weight for the method blank, DA blank, and spike calculations.

5. Responses and targets must be entered in mg/L.

6. Generate spike recovery/control chart data for Information Services.

NOTES:

Signed ____________________ Date ______________

USATHAMA - Metals
Computer QC Checks

Batch No.:_____ Lot No.:______ Analysis Date:________ Analyst:_______

| | YES | NO | Comment/Corrective Action |
|---|---|---|---|
| Extract holding time within criteria? | | | |
| Analysis holding time within criteria? | | | |
| No. of calibration standards present acceptable? | | | |
| Curve correlation coefficient >= 0.995? | | | |
| Sample responses within the highest standard response? | | | |
| Interference Check Solution (ICS) present? | | | |
| ICS within acceptance criteria? | | | |
| Initial Calibration Verification solution (ICV) present? | | | |
| ICV within acceptance criteria? | | | |
| End of Run Calibration Verification solution (ECV) present? | | | |
| ECV within acceptance criteria? | | | |
| Continuing Calibration Verification solution (CCV) present? | | | |
| CCV within acceptance criteria? | | | |
| Continuing Calibration Blank (CCB) present? | | | |
| Method blank present? | | | |
| Standard matrix spikes present? | | | |
| Standard matrix spike targets correct? | | | |

Note: Any "NO" answer requires a comment.

# USATHAMA
## Manual QA/QC Batch Checklist for Atomic Spectroscopy

Batch No.:____ Lot No.:______ Analysis Date:________ Analyst:______

| | N/A | YES | NO | Comment/Corrective Action |
|---|---|---|---|---|
| Are reported values consistent with the required units? | | | | |
| Do the calibration standards bracket the concentration equivalent to the method detection limit and the upper certified concentration? | | | | |
| Is the calibration curve entered correctly? | | | | |
| If sample concentrations above the certified range are reported, were extracts diluted to within the certified range prior to analysis? | | | | |
| Are dilution factors entered correctly? | | | | |
| Have reported sample concentrations been adjusted for percent moisture and sample volume/weight? | | | | |
| If sample concentrations have been corrected for the method blank, was an appropriate explanation supplied? | | | | |
| Was the batch checked for data entry errors? | | | | |
| Were continuing calibration standards (CCV) analyzed at the appropriate frequency? | | | | |
| Were continuing calibration blanks (CCB) analyzed at the appropriate frequency? | | | | |
| Is an example calculation provided? | | | | |
| Has the lot table of contents/checklist been completed? | | | | |

Note: Any "NO" answer requires a comment.

Completed By______________________ Reviewed by__________________
Date______________________________ Date________________________

# APPENDIX E

## Data Management SOPs

TABLE OF CONTENTS
Appendix E

# E.1

## Laboratory Data Management

# LABORATORY DATA MANAGEMENT

ESE has developed the Chemical Laboratory Analysis and Scheduling System (CLASS), c. 1989., which is an automated in-house data management system that integrates information from sample collection, laboratory analyses, and QC requirements and calculates, checks, stores, and reports data in many different formats. The CLASS system resides on a Novell Arcnet PC network with 1600 megabytes of disk storage, and is connected to 65 PC's placed throughout the chemistry laboratories and offices. ESE has incorporated into this system, the ability to combine analytical results, method certification, QC, and site-specific data in order to produce files in a format acceptable to USATHAMA data checking routines. The way in which data will be handled for this project is shown in detail in Fig. 3-1.

USATHAMA QC procedures have been integrated into ESE CLASS. The data system manages the flow of samples through the laboratory. Prior to sampling, the laboratory coordinator provides information on the number of samples, site identifications, parameters to be analyzed, and estimated collection date. This information is entered into CLASS and is used to produce sample labels and chain-of-custody logsheets (Figs. 3-2 and 3-3). A unique ESE number is assigned to each sample, and labels with that number are placed on each container for that sample. Site identification will be on the labels and logsheets to ensure the integrity of the chain-of-custody and tracking system.

At each site, samples are collected and placed in the appropriate pre-labeled containers. The logsheet is marked, noting the collection date and time and recording the sample type, site type, sample depth, and sampling technique.

After collection, samples accompanied by the logsheet are sent to the laboratory and received by the laboratory coordinator. The laboratory coordinator checks the sample containers against the information recorded on the logsheet and notes any discrepancies. The laboratory coordinator submits the logsheet to data management personnel. Samples are logged into the CLASS system by the data management personnel. Sample collection date and time are entered so that holding times can be readily monitored.

ESE uses a combination of U.S. Environmental Protection Agency (EPA) Storage and Retrieval (STORET) numbers and USATHAMA method codes to designate parameters required for analysis. For example, arsenic in water would be denoted by 1002*SD03, since the STORET number for arsenic is 1002 and the USATHAMA certified method code is SD03. A list of all required parameters is logged into the computer with each sample. Each STORET-method

combination has its own QC requirements specific to that analysis.

Each list that is set up on the system includes the following data entries to facilitate converting data into the IRDMS format.

| ESE and EPA STORET numbers | Parameters |
|---|---|
| 71999 | Sample Type |
| 99759 | Site Type |
| 72015 | Sample Depth [Feet (FT)] |
| 72005 | Sampling Technique |
| 99720 | Installation Code |

The information is taken from the field log sheet and entered into CLASS so that it can be incorporated into the chemical data record.

The sampling information is entered into the computer to activate the parameter list for the samples collected and received by the laboratory. A notice of sample arrival and short holding times is immediately sent to the analytical team leaders. The report of samples available for each analysis will indicate the number of days left before the holding time is exceeded. This report is distributed to each analytical department daily, and the information also can be accessed readily from CLASS by the laboratory coordinator or any analyst in the Chemistry Division. Samples are stored in a locked coldroom and can be removed only by signing the appropriate chain-of-custody form.

SAMPLE IDENTIFICATION NUMBERS

ESE uses a batch method for analyzing, checking QC, and calculating final results of samples. Prior to analyzing a batch of samples, the analyst will designate a specified group of samples in the computer and the sample-parameter status will be updated to IL (in laboratory). The basis for this grouping technique is that samples are analyzed in groups for the same method that can be extracted or analyzed (whichever is the most limiting factor) in one 24-hour period. The analytical batch is assigned a unique batch control number, which is stored with all final data, so data can be checked and original documentation can be retrieved. For USATHAMA projects, a 3-character alphabetical lot designation also is assigned to each analytical batch. Only USATHAMA samples will be included in any batches that contain USATHAMA samples. Each sample in the batch is assigned a numerical suffix, starting with 001 to the 3-character

alphabetical prefix. Using this scheme, there will be a direct relationship between ESE's unique sample number and the USATHAMA sample number for each lot.

REQUIREMENTS FOR SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples will be analyzed within the holding times for each method. The analysis of each laboratory batch usually consists of a multistage process. In the first stage, instrument calibration, the ESE data management system includes several QC checks. The linear or quadratic regression equation and correlation coefficient are calculated from the calibration curve data, and the correlation coefficient is tested to determine whether it is within an acceptable range specific to the analysis. In addition, the constancy of the calibration response is checked by comparing preanalysis and postanalysis standard response and/or response factors. Method blank and control spike information are then entered and results are calculated and checked against control limits as calculated for that method by certification and prior lots. Sample responses are entered into the batch, and final concentrations are calculated for each sample.

Software has been developed to interface output of data from some laboratory instruments directly into CLASS, thus minimizing typographical errors. These instruments include:

1) GC/MS for both volatile and semi-volatile analysis.
2) ICP and Graphite Furnace.
3) Ion chromatography and Tracs autoanalyzer.

If the data fail the QC checks, appropriate actions (such as reanalyzing the samples or correcting transcription or data reduction errors) are taken.

Analysts use the computer to reserve samples for analysis and to interactively check calibration curves and QC results. By allowing the analyst to enter data directly and check QC and sample results, the analyst is notified immediately of QC problems. Thus, any necessary corrective actions can be taken before more analyses are completed. Laboratory analysts are not permitted to update sample records. When the analyst has entered the QC and sample data, the Army lot, including worksheets and any other pertinent documentation (such as chromatograms), is placed in a file folder and submitted to the data management supervisor. The computer produces a batch summary report by incorporating chemical, field, and certification data, and a file formatted so that it can be read into and checked by the IRDMS data checking routines. These printouts, along with the data

package from the laboratory analyst, are placed in a folder and attached to the Army data transmittal form (Fig. 3-5) for review and approval by the team leader, the laboratory coordinator, and the QA supervisor. The QA supervisor will then validate the data by checking random data points against raw data.

After review and QA validation are complete for a lot, the data management personnel will enter the formatted file into the IRDMS data acceptance routines for record and group checking.

Record check verifies that:

1. Data are correctly formatted,
2. The laboratory is certified for the method,
3. Test names are valid for the method,
4. Concentrations are within certified range or properly diluted within range.

Group check verifies that:

1. A lot contains the correct number of QC samples,
2. All analytes for the method are present, and
3. All sites in a lot have a map record in the database.

When all checks are passed, a transfer file will be created from the system and sent to the USATHAMA computer via telephone lines.

USATHAMA will run further data checks when ESE data files are received. After passing the checks, the files will be elevated to Level 2.

# DATA TRACKING

ESE understands the importance to USATHAMA of maintaining task order analysis schedules. Data generated in a timely manner are critical to decision making concerning remedial actions and also for meeting regulatory reporting deadlines on monitoring efforts. A coordinated functional mechanism for maintaining analytical data reporting schedules is critically important.

ESE uses tested mechanisms to:

* Notify analytical task managers and team leaders of the arrival of samples for analysis in a timely manner;
* Track the status of samples through the laboratory analysis and review procedures;
* Monitor compliance with sample holding times via a computerized tracking procedure; and
* Communicate delays in the sample analysis and/or review chain to project management in a timely manner to implement effective corrective actions.

## AVAILABLE NUMBERS REPORT

As part of ESE CLASS, each analytical team leader receives a daily listing of all samples requiring analysis by a particular method. Samples appear on this report within 24 hours of receipt in the laboratory and after log-in into CLASS. In addition to providing notification of sample availability for analysis, the available sample numbers report also provides the team leader and analyst a list of the number of days left in order to meet the required holding times for the analysis and the number of days before the data are due.

In addition, the ESE laboratory has a person designated as the Sample Tracking Assistant (STA) whose responsibilities include the daily checking of the status of samples which are nearing holding times for extraction and/or analysis. If a sample has only 1 day (3 days if on a weekend) left before holding time will be exceeded, the STA notifies the analytical team leader and the laboratory task manager in writing. Followup and corrective action may then be instituted.

CHEMTRAK

USATHAMA lots are tracked through the analytical laboratory and data review chain using a PC-based computer program called Chemtrak. This program was written especially for USATHAMA projects by ESE to provide a management tool for laboratory coordinators and project managers to identify problem areas causing schedule slippage. The program functions as follows:

* As soon as lot assignments are made, the following information is entered into the computer: lot number, analytical method, installation, and date of earliest sample in the lot;

* From that information, the program calculates the date the completed analytical lot is due from the laboratory to the data management supervisor for processing and the dates due for completion of supervisory and QA review based on the required schedule (expedited, 40 or 55-day schedule) for the data to be through the IRDMS data checking routine and elevated into Level 2; and

* Weekly reports are produced by method and by installation to indicate the status of lots not completely through the system. These reports are circulated to analytical department managers, laboratory coordinators, and QA staff.

JEFFERSON DL P 9/88E

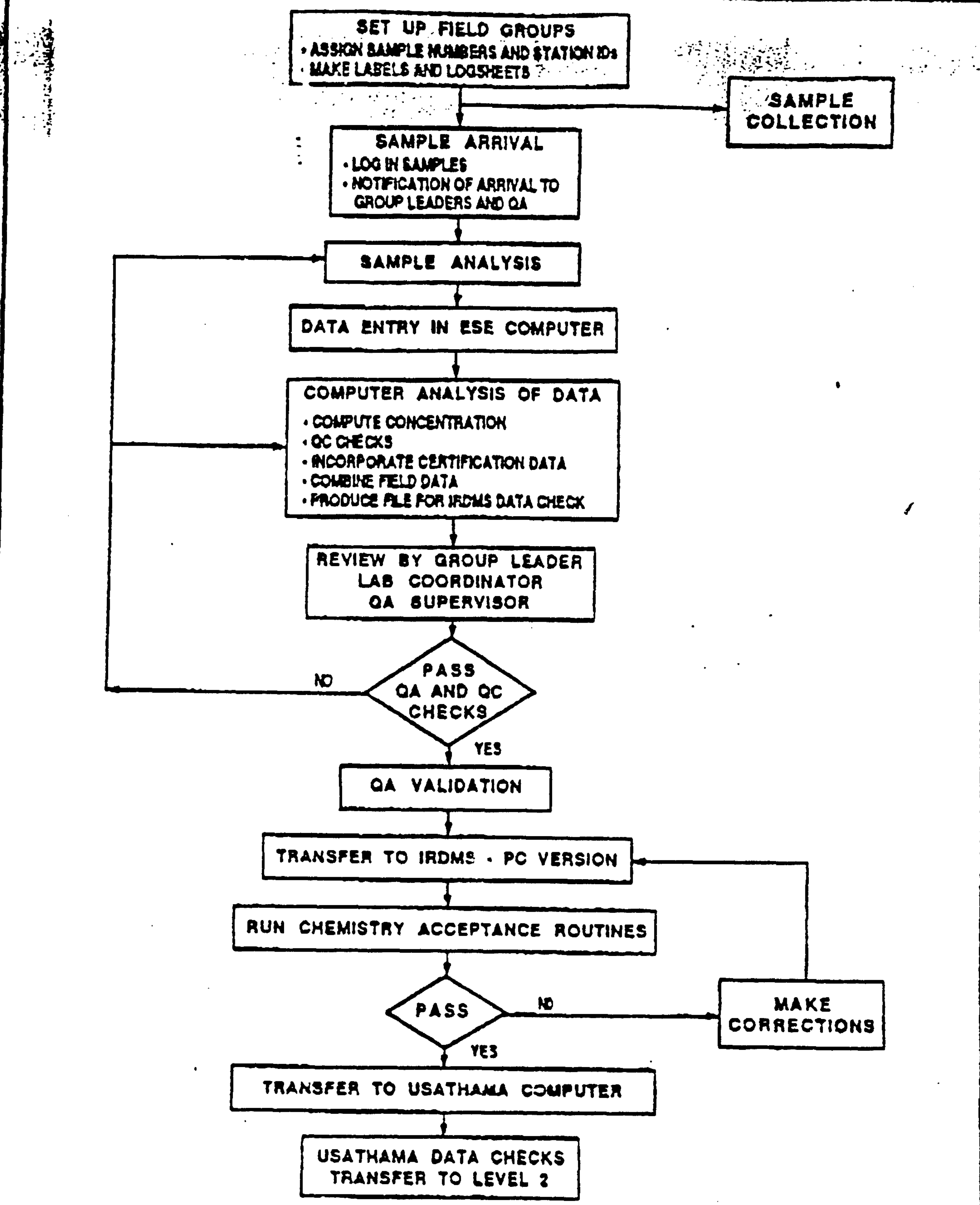


Figure 3-1
OVERVIEW OF DATA MANAGEMENT PROCEDURES FOR USATHAMA ANALYSES

SOURCE: ESE, 1988.

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

JEFFERSON DWP 1986

ESE#86536 0942 507A
SHARPE ARMY DEPOT
SHMWP1#1-VP
SAMPLER DATE TIME
PH COND

ESE#86536 0942 507A
SHARPE ARMY DEPOT
SHMWP1#1-VP
SAMPLER DATE TIME
PH COND

ESE#86536 0942 507A
SHARPE ARMY DEPOT
SHMWP1#1-VP
SAMPLER DATE TIME
PH COND

ESE#86536 0942 507A
SHARPE ARMY DEPOT
SHMWP1#1-VP
SAMPLER DATE TIME
PH COND

ESE#86536 0942 507A
SHARPE ARMY DEPOT
SHMWP1#1-NF
SAMPLER DATE TIME
PH COND

ESE#86536 0942 507A
SHARPE ARMY DEPOT
SHMWP1#1-C
SAMPLER DATE TIME
PH COND

ESE#86536 0942 507A
SHARPE ARMY DEPOT
SHMWP1#1-HB
SAMPLER DATE TIME
PH COND

ESE#86536 0942 507A
SHARPE ARMY DEPOT
SHMWP1#1-HB
SAMPLER DATE TIME
PH COND

ESE#86536 0942 507B
SHARPE ARMY DEPOT
SHMWP1#2-VP
SAMPLER DATE TIME
PH COND

ESE#86536 0942 507B
SHARPE ARMY DEPOT
SHMWP1#2-VP
SAMPLER DATE TIME
PH COND

ESE#86536 0942 507B
SHARPE ARMY DEPOT
SHMWP1#2-VP
SAMPLER DATE TIME
PH COND

ESE#86536 0942 507B
SHARPE ARMY DEPOT
SHMWP1#2-VP
SAMPLER DATE TIME
PH COND

ESE#86536 0942 507B
SHARPE ARMY DEPOT
SHMWP1#2-NF
SAMPLER DATE TIME
PH COND

ESE#86536 0942 507B
SHARPE ARMY DEPOT
SHMWP1#2-C
SAMPLER DATE TIME
PH COND

ESE#86536 0942 507B
SHARPE ARMY DEPOT
SHMWP1#2-HB
SAMPLER DATE TIME
PH COND

ESE#86536 0942 507B
SHARPE ARMY DEPOT
SHMWP1#2-HB
SAMPLER DATE TIME
PH COND

Figure 3-2
ESE SAMPLE LABLES

SOURCE: ESE 1987

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

ENVIRONMENTAL SCIENCE & ENGINEERING 05-07-87 *** FIELD LOGSHEET *** FIELD GROUP: SHMWP1
PROJECT NUMBER 86536 0942 PROJECT NAME: SHARPE ARMY DEPOT LAB COORD. JACKIE HARGROVE
SHMWP1

| ESE # | SITE/STA | HAZ? | FRACTIONS(CIRCLE) | DATE | TIME | PARAMETER LIST | SAM TYPE | SITE TYPE | DEPTH | S TECH | INSTAL SAMPLE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *1 | 507A | | VP VP VP VP NF C HB HB | | | SHAD-W | | | | | |
| *2 | 507B | | VP VP VP VP NF C HB HB | | | SHAD-W | | | | | |
| *3 | 507C | | VP VP VP VP NF C HB HB | | | SHAD-W | | | | | |
| *4 | 511C | | VP VP VP VP NF C HB HB | | | SHAD-W | | | | | |
| *5 | 511A | | VP VP VP VP NF C HB HB | | | SHAD-W | | | | | |
| *6 | 511B | | VP VP VP VP NF C HB HB | | | SHAD-W | | | | | |
| *7 | 508A | | VP VP VP VP NF C HB HB | | | SHAD-W | | | | | |
| *8 | 508B | | VP VP VP VP NF C HB HB | | | SHAD-W | | | | | |
| *9 | 508C | | VP VP VP VP NF C HB HB | | | SHAD-W | | | | | |
| *10 | 520A | | VP VP VP VP NF C HB HB | | | SHAD-W | | | | | |

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I IGNITABLE C CORROSIVE R REACTIVE T TOXIC WASTE H OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN LOGSHEETS WITH SAMPLES TO ESE

| | RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME) | RECEIVED BY (NAME/ORGANIZATION/DATE/TIME) |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |

OTHER FIELD NOTES FOR FIELD GROUP SHMWP1:

Figure 3-3
ESE SAMPLE LOG SHEET

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Mary

# E.2

# Creation of Control Charts

# S.O.P FOR CREATING CONTROL CHARTS

When control charts submittal is received from the analyst go to the "USATHAMA" menu. In the USATHAMA menu choose option "ENTER QC CHART DATA" and press <ENTER>.

1) ENTERING OF CONTROL CHART DATA IN CLASS SYSTEM

A)Enter storet number that has % recoveries <ENTER>.
B)Enter method and <ENTER> six times.
C)Press 'F4' and page down until end of file and arrow down one time.
D)Enter lot name <ENTER>, analysis date <ENTER>, % recovery or recoveries.
E)Press 'SHIFT F1' to run the outlier test which only takes a few seconds, then press 'F9' to save.
F)Go to the next storet in batch that has % recoveries and start with A) (this time the method will default).
G)When data is entered for all qc chart submittals received from analyst, enter appropriate information in the CONTROL CHART STATUS NOTEBOOK, then go to step 2), ENTERING OF CONTROL CHART DATA IN THE ARMY SYSTEM.

2) ENTERING OF CONTROL CHART DATA IN THE ARMY SYSTEM

A)Set printamer for quadram epson emulation mode, server = class, output = cclaser, and copies = 2.
B)Go to C:\IRCC and type CCS <ENTER>, your initials <ENTER>, and the method being added <ENTER>.
C)When the IR CONTROL CHARTS MAIN MENU appears press 2, then 3.
D)Enter the test name of storet being entered <ENTER>.
Enter lot number <ENTER>.
Enter analyst initials <ENTER>.
Enter analysis date <ENTER>.
The certification level defaults so return past it.
Enter the low target value <ENTER>.
Enter the found for the low target value <ENTER>.
Press 'F10' to save.
E)If there are high spikes, enter the target and founds the same way they were entered for the low spike, otherwise enter the next compound in method until all compounds are entered.
F)Go to the next method by pressing 'ESCAPE' until the IR CONTROL CHARTS MAIN MENU APPEARS. Press 6 and enter the next method to be entered, then press 3 and start with step D).
G)When all data is entered for all methods go to step 3), PRINTING OF CONTROL CHARTS.

3)PRINTING OF CONTROL CHARTS

A)While in the IR CONTROL CHARTS MAIN MENU, press 6 and enter in the method to be printed.
B)After program has accessed data, press 4 (CREATE CONTROL CHARTS), 1 (ALL TESTS NAMES), 1 (ALL CHARTS AND TABLES), 1 (LAST 20 LOTS), 2 (PRINT CHARTS AND TABLES), AND 1 (EPSON).
C)To print next method, press 3 and enter the next method to be printed.
D)When data has been accessed for method, press 2 then 1.
E)When charts have finished printing, press 'ALT 2' and then E to endspool the file. Then go to step 4), DISTRIBUTION OF CONTROL CHARTS.

4)DISTRIBUTION OF CONTROL CHARTS

A)After all charts have printed, the first copy goes to the analyst and the other copy to Hugh (On the top right hand side of my desk Hugh's copies will accumulate throughout the week until he comes to get them).
B)When all charts have been printed and handed out to the analyst, the hard drives need to be backed up on the 486 and 386 computers. Go to step 5), BACKING UP THE HARD DRIVES.

5)BACKING UP THE HARD DRIVES

A)At the end of each day, both hard drives need to be backed up on the 486 and 386 computers.
B)On the 486, copy all files (except CC.* and SD20.*) updated by the end of each day to the subdirectory of I:\TEMP\486. (All files updated by the end of the day will have a file attribute of A. This makes it easy to distinguish which files have been updated.)
C)On the 386, copy all files (except cc.* and SD20.*) updated by the end of each day to the subdirectory of I:\TEMP\386.
D)On the 486, copy all files in I:\TEMP\386 to C:\IRCC.
E)On the 386, copy all files in I:\TEMP\486 to C:\IRCC.
F)All files in I:\TEMP\386 and I:\TEMP\486 need to first be copied to I:\TEMP\CHARTS, then deleted.
G)The file attributes of A need to be cleared. Type DR in C:\IRCC on both the 486 and 386 computers and press 'F6' to mark all files, then 'ALT F6' to change file attribute. Type -A and return. Now go to step 6), UPDATING CHEMTRAK.

6)UPDATING CHEMTRAK

A)All lots entered in the CONTROL CHART STATUS NOTEBOOK need to be entered in chemtrak.
B)In CLASS press 'F5' and type CHEMTRAK.
C)When CHEMTRAK window appears, enter the lot, analysis data, batch number, and QC REC'D = Y, then press 'F9' to save.
D)This needs to be done at the end of each day for all lots received.

E)Usually, there will be a submittal every week to enter in CHEMTRAK too.
F)For submittals only: enter lot, QC.DATE = submittal date, QC SENT = y, and QC.QA = y, then press 'F9' to save.
G)Enter submittal date in the CONTROL CHART STATUS NOTEBOOK under date sent column for each appropriate lot.

# E.3

## Processing and Transmittal of Data (Using IRDMS)

**PROCESSING AND TRANSMITTAL OF USATHAMA CHEMICAL DATA USING IRDMIS**

STANDARD OPERATING PROCEDURE

SOP4152-06

This Standard Operating Procedure (SOP) describes the process followed to Process and Transmit USATHAMA chemical data to Level II.

DATE:____________ AUTHORIZED BY:__________________

DISTRIBUTION:

PROCESSING AND TRANSMITTAL OF USATHAMA CHEMICAL DATA USING IRDMIS

SOP

## 1.0 Objective

The objectives of this standard operating procedure are to ensure that the proper procedures are followed in:

1.1 Preparing USATHAMA lot data files for processing using IRDMIS.

1.2 Processing USATHAMA lot data files using IRDMIS.

1.3 Transmitting USATHAMA transfer files to PRI.

1.4 Definition: IRDMIS - Installation Restoration Data Management Information System - is the menu-driven PC program group used to process USATHAMA chemical, geotechnical and map data for transmittal to Potomac Research, Inc. (PRI) and USATHAMA.

Further detailed information may be obtained by referencing the official **USER'S MANUAL** for the **IRDMIS PC Data Entry & Validation Subsystem**, and the **USATHAMA USER'S GUIDE, VOL. II (Data Dictionary)**.

## 2.0 Scope

This standard operating procedure applies to all USATHAMA data.

## 3.0 Procedures

There are seven steps involved in processing and transmitting data using IRDMIS. They are as follows:

1) Preparing USATHAMA lot files for upload into IRDMIS. 2) Uploading lot files into IRDMIS.

3) Running Record Check on the lots.

4) Running Group Check.

5) Creating IRDMIS transfer files for the lots being processed.

6) Transmitting transfer files to PRI (Level II).

7) Documentation for the lots which have been transferred.

**3.1 Preparing USATHAMA lot files for upload into IRDMIS.**

To prepare USATHAMA lot files for upload, go to O:\ARMY and call up the ARMY validation file in brief. The ARMY validation filename is written on the lot cover sheet in the 'comments' section of the 'Data Coordinator' box. See Exhibit A titled 'Chemical Data File Formats' to resolve any questions about the format of the data in the validation file. Make the following alterations to the validation file.

3.1.1 Make sure that there is a '0' after M0.00 (correct to M0.00 0) in column 36, for the method blank. Do the same for Site Types FBLK, RNSW, and TRIP (ie. F0.00 0, R0.00 0, T0.00 0).

3.1.2 On line 1, add '88.1' starting in column 59. This code assures that units for depths are read as 'feet.'

3.1.3 On line 1, in columns 31-32, add the correct code for prime contractor (reference the USATHAMA users guide, section 9.15)

3.1.4 On the sample lines (i.e. S001, S002, etc.) in column 72, add the correct base closure code (Y or N). This information should be supplied by the Lab Coordinator).

3.1.5 On the sample lines, in columns 73-76, add the Sample Delivery Order Number (to be supplied by the Lab Coordinator).

3.1.6 Correct any values (except depths) which are reported as 10.0 to 01.0.... (ie 10.0-02 = 01.0-01).

3.1.7 Make sure that all required field data is present.

**3.2 Uploading USATHAMA files into IRDMIS.**

Before loading a new group of lots into IRDMIS for processing, 'ZAP' lot files already transferred out of IRDMIS. To do this, go to C:\ and type 'ZAP'. This will clean out the database files.

From C:\ , type 'IR.'

3.2.1 When prompted to 'Press any key to continue,' do so.

3.2.2 After 'Zapping' the database files, it is necessary to reindex the files. To do this, choose number 4 from the menu - Utilities. Then choose 3 - Index all data bases.

To begin uploading USATHAMA files:

3.2.3 Choose number 1 from the menu - Chemical Data.

3.2.4 Choose number 1 from the menu - Enter New Data.

3.2.5 At the prompt for 'mode of entry,' press 'F' for file input.

3.2.6 Enter the name and location of the file to upload (O:\ARMY\FILENAME).

3.2.7 Press <enter> when done to return to the menu.

## 3.3 Running IRDMIS Record Check.

Before running Record Check, go to a network directory and set up the PrinTamer so that any Record Check errors can be captured and printed so we have a hard copy of them. PrinTamer will not be able to read the PDF file and load the fonts from the c: drive.

3.3.1 From the IRDMIS Chemical Data Main Menu, choose number 4 - Record check existing data.

3.3.2 Enter the lots to be processed by either manually typing in the Installation code, Laboratory, and Lot number, or by pressing <page down> to call up a window which displays the lots. In the window, press the number (1 to 5) of the lot to process, and press <page down> again. If the number of lots is greater than 5,

pressing the <space> bar will show the second, third, etc, group of 5 lots.

3.3.3 Press 'N' when all lots to be processed are loaded in.

3.3.4 IRDMIS will either report that a lot is clean, or that it is in error and ask if you wish to edit the data found in error. If it is clean, simply record the lot and the number of analysis records in the Lot Transfer Verification Book. If it is in error, press 'Y' to edit. Using the PrinTamer, make a hardcopy of the screen showing the error(s). Then follow the procedure in appendices A and B for correcting and/or documenting errors.

**3.4 Running IRDMIS Group Check.**

After lots have been run through Record check and are clean, or which contain errors deemed acceptable:

3.4.1 Chose number 5 - Group check existing data - from the menu.

3.4.2 Load the lots to be checked, as in Step 3.

3.4.3 If a lot contains an error, IRDMIS will report that 'This lot contains invalid data - Do you wish to contine (Y/N).' Press 'Y' if the error has been deemed acceptable.

3.4.4 When all lots have been loaded, IRDMIS will show the filename which the results will be written to: \IRSCC\SCC91001.GRP. The numeric part of the filename is the Julian date, in this case 91001.

3.4.5 When processing is complete, print the SCC file. Review the results for errors. Once all errors are deemed acceptable, or all lots check clean, go to step 5.

**3.5 Creating IRDMIS transfer files.**

3.5.1 Choose number 6 - Output existing data - from the menu.

3.5.2 Press 'T' to create a transfer file.

3.5.3 IRDMIS will show the default subdirectory and filename for the TRN file.

3.5.4 Change the subdirectory from \IRSCC to \TRNIR.

3.5.5 Once all desired lots have had transfer files created, go to C:\TRNIR.

3.5.6 Type 'PACKES' to create an archive file of the transfer files.

3.5.7 Create a README file (READMonthDay.Year - READ414.91, etc) listing the transfer files being transmitted, and their status as clean or in error. (See previous README files for details).

3.5.8 PACKES will change the *.trn ending to *.trr so that once a trn file has been put in an archive file, it will not be picked up again.

3.5.9 Copy the *.arc and the readme file onto a disk (use the disk in the back of the IR TRN Temp Disk section in the disk filer) after deleting any files on the disk.

**3.6 Transmitting USATHAMA transfer files to PRI (Level II).**

3.6.1 Copy the ES*.ARC and READ*.91 files into c:\xtalk on the Army Multitech in the main data room. At C:\XTALK type **XTALK PYRAMID**. Hit [enter] so that xtalk begins dialing. After connection is made, hit [enter] once or twice, type in **a** for terminal identifier, and type in **thama** for login \ user name. A message will appear, hit [enter], and then type **att** for service. Next, hit the [tab] key to get to the command line. Type in **da 8**, hit [enter], and type in **bbs**. Usually you have to type bbs and [enter] and then type bbs and [enter] again. The second time you should see **bbs**. At this point, hit [escape] to return to the command line, and type **da 7**.

This will log in to the bbs. Continue through until you get to enter username. Put in username, and password, in response to queries from bbs. Choose sIg access, choose # 21 from list, choose File area, and then choose Upload. Follow the instructions to upload the files. After uploading a file, type in comments, ie. 'irdmis transfer files' and 'readme file for es000001.arc'. Select Goodbye to exit the bbs.

**Accessing PRI through the 3com network**

Accessing PRI through the 3com network will soon be obsolete. However, these are the instructions for doing so.

3.6.2 Insert the 3com boot disk into the A: drive of the communications PC and reboot the PC.

3.6.2 When the PC shows the A:\> prompt, go to c:\ and type 'login ese.'

3.6.3 When login is completed, type '3f link e:'; when E:\> is linked, go to e:\ and type 'prompt $p$g.' Then type 'cd transfer.'

3.6.4 At E:\TRANSFER>, type 'copy a:*.*'. When all files have been copied, go to A:\ and type '3r h'. When the light on the a: drive goes out, reboot the pc and take out the disk. Transmittal is complete.

**3.7 Documentation of transferred lots.**

Documentation consists of recording the lot, date of transfer, number of analysis records, and lot status (clean or not) in the Lot Transfer Verification Book. It also consists of printing out a hardcopy list of the lots, archived filename, and readme filename.

3.7.1 At C:\TRNIR, type DIR >C:\TRNIR\RECORD\RECORD.xxx, where the extension is the month and day of the transmittal. The DIR > command will list the entire contents of the directory to the file Record.xxx, which will be located in the directory

C:\TRNIR\RECORD. By editing this file in brief, a list of the transferred files can be easily obtained.

3.7.2 Print out all of the lot transfer files, two copies of the readme file and two copies of the Record.xxx file. This may be done easily by using a batch file.

3.7.3 Copy all of the lot transfer files and the readme file to the current disk of 'Files Sent to PRI'.

3.7.4 Upload the readme file into the Lot Verification screen. At the main CLASS menu, choose the USATHAMA submenu. Choose the UNISYS submenu, and then choose Lot Verification. Enter the directory and filename of the readme file, and the date of the readme file. This will add the PRI date to CHEMTRAK.

3.7.5 Move the readme file to the directory C:\TRNIR\README, and delete the readme file and the lot transfer files from the C:\TRNIR directory.

This completes the process. See appendices A-B, and exhibit A for additional information.

Appendix A

**1.0 Objective**

The objectives of this appendix are to ensure that the proper procedures are followed in correcting and/or determining the acceptability of errors occurring in IRDMIS processing.

**2.0 Scope**

This appendix applies to all USATHAMA lot data files encountering errors in IRDMIS processing.

**3.0 Procedures**

3.1 If the error lies with the field data and /or sampling dates, first check the logsheet to assure that the correct field data and sampling data have been entered into the lot. If the error is with the chemical data, go to step #3.

3.2 If the field data and sampling date on the logsheet match the data in the lot file, use the IRDMIS data dictionary to find the correct site types which are allowable for the filename give (CSO, CSE, CSW, CGW, etc.).

3.3 Then consult with the lab coordinator to verify the correct data which can then be entered upon obtaining a written correction notice from the lab coordinator. In the case of chemical data, verify that the data are in error and obtain a written explanation which can be submitted upon transmission data to Level II.

3.4 If all the data seem to be correct, yet the error message persists, contact Virginia O'Brien so that she can contact PRI in order to determine whether and how the data can be submitted, and if the error lies with the data or with the software.

3.5 When errors have been corrected, rerun the lots in question through Record and Group check again to clean them up. (IRDMIS flags errors

internally so that lots in error must be run through again when clean in order to remove the error flag.)

## Appendix B

**1.0 Objective**

The objectives of this appendix are to ensure that the proper procedures are followed in documenting USATHAMA lot errors which occur in IRDMIS processing.

**2.0 Scope**

This appendix applies to all USATHAMA data encountering errors in IRDMIS processing.

**3.0 Procedures**

3.1 USATHAMA lots arrive from Quality Assurance. The lots are uploaded into the IRDMIS system and processed.

3.2 Lots without Record and Group Check errors are sent to PRI according to regular procedure.

Lots which contain errors are dealt with in the following manner:

3.3 Lots which contain errors which can be resolved by consulting with the project and/or lab coordinator shall be corrected as per their instructions and reprocessed. (Errors of this type include incorrect Site ID's, Missing Map data, etc.) If the lot the checks clean, it will be sent to PRI according to regular procedure.

3.4 Lots which contain errors which are due to lab / analysis / other situations which cannot be corrected shall be handled as follows:

3.4.1 A hardcopy screen printout of the errors as they occur in IRDMIS will be obtained to document the exact error message and the data in error.

3.4.2 This printout shall be attached to the IRDMIS PROCESSING

COMMENT FORM, which will contain explanations of the data in error, the reason for the error, and any other documentation pertaining to the error. The Group Check results will also be attached. This documentation shall then be added to the lot folder. A copy shall be made for ESE files, so that ESE can retain documentation of the errors independent of the lot folder.

3.4.3 Upon submittal to PRI, a README file will be included in the transmittal which will include the explanations included in the IRDMIS Processing Comment Form.

Note: Lots which pass both Record and Group checks will not have an IRDMIS Processing Comment Form included in the lot folder. The Group check results printout will serve as documentation of the lot having checked cleanly.

3.5 Lots which fail only because of missing map information will be dealt with as follows:

3.5.1 If USATHAMA has authorized the submission of installations for which we are missing map information, these lots shall be sent to PRI. These lots will not have an IRDMIS Processing Comment Form, as the Group check record shall be sufficient documentation.

3.5.2 If USATHAMA has not authorized the submission of installations for which we do not have map information, these lots shall not be sent. The project manager or lab coordinator will be notified so that map information can be obtained. These lots will be held pending reception of map information, or authorization to sent without maps.

Exhibit A

# Chemical Data File Formats

## Lot Record

| Columns | |
|---|---|
| 1 | "L" |
| 2-3 | Installation Code |
| 4-5 | Laboratory Code |
| 6-8 | Lot Number |
| 9-12 | Method Number |
| 13-16 | Units |
| 17-19 | Initials |
| 20 | Class Indicator |
| 24 | Delivery Order Indicator |
| 31-32 | Prime Contractor |

## Sample Record

| Columns | |
|---|---|
| 1 | "S" |
| 2-4 | Sample Number |
| 5-7 | File Name |
| 8-11 | Site Type |
| 12-21 | Site Identification |
| 22-29 | Field Sample Number |
| 30-37 | Sample Date (MM/DD/YY) |
| 38-40 | Sample Program |
| 41-46 | Sample Depth |
| 47 | Sample Technique |
| 48-55 | Laboratory Sample Number |
| 56-63 | Sample Preparation Date (19YYMMDD) |
| 64-71 | Analysis Date (19YYMMDD) |
| 72 | Base Closure |
| 73-76 | Delivery Order Number |

## Analysis Record

| Columns | |
|---|---|
| 1 | "A" |
| 2-7 | Test Name |
| 8-9 | Boolean |
| 10-13 | Uncorrected Mantissa (#.##) |
| 14-16 | Uncorrected Exponent |
| 17-19 | Dilution Mantissa (#.##) |
| 20 | Dilution Exponent |
| 21-24 | Moisture (##.#) |
| 25-28 | Accuracy |
| 29 | Flagging Code |
| 30 | QCtest Code |
| 31-34 | QC Mantissa (#.##) |
| 35-37 | QC Exponent |

E.4

Extraction/Analysis EPA Holding Time Tracking

# EXTRACTION/ANALYSIS EPA HOLDING TIME TRACKING

## STANDARD OPERATING PROCEDURE

## SOP 4101-06.1

This Standard Operating Procedure (SOP) describes the daily practice of monitoring samples that are approaching EPA holding time deadlines.

**DATE:** ______________ **AUTHORIZED BY:** ____________________

**DISTRIBUTION:**

# EXTRACTION/ANALYSIS EPA HOLDING TIMES TRACKING

## SOP 4101-06.1

## 1.0 Objective

The objective of this standard operating procedure is to explain the following practices involved in tracking EPA holding times:

1.1 Generating a master list of samples close to holding time deadlines.

1.2 Checking status of samples in the lab.

1.3 Notifying the proper personnel about samples' status.

## 2.0 Scope

This standard operating procedure applies to all samples in house except for samples involved with special interest projects that don't follow EPA holding time guidelines.

## 3.0 Procedures

### 3.1 Generate master list of samples

3.1.1 Materials needed to create the sample list:

3.1.1.1 A copy of available numbers purposely generated daily by CLASS for this procedure.

3.1.1.2 The lab's available numbers located in L:\TEMP: 3243LC.AVN, 3243LCX.AVN, 3243GC.AVN, 3243GCX.AVN and GLENN.

3.1.2 Separate the samples into seven different categories: HPLC, GC NON-VOLATILE, GCMS, GC VOLATILE, TECHNICON, MERCURY and WATER QUALITY (see Exhibit 2).

3.1.3 Write down and track all samples that have holding times of four days to zero day left chronologically in their respective category. Samples are displayed on available numbers by parameters and/or individual groups, i.e.

VOA, MISC3243LC, HALL, etc..

3.1.4 Update the sample entries daily. Add new samples at the bottom of their appropriate category. There is no need to update samples that already have been extracted/analyzed and still appear on available numbers.

3.1.5 Start a new sample record at the beginning of every week.

3.1.6 Remember to adjust the length of holding time tracking for holidays.

**3.2 Checking sample status**

3.2.1 Extraction holding times

3.2.1.1 HPLC, GC NON-VOLATILE, and GCMS(NVO) categories are tracked through Department 3242. To locate the extraction logsheets, look in the box outside the organic wetlab technicians' office or in the appropriate technician's extraction logbook. If the extraction logsheet cannot be located ask the department manager to provide a copy.

3.2.1.2 For any other miscellaneous extractions done in other categories, ask the department manager.

3.2.2 Analysis holding times

3.2.2.1 For the HPLC and GC NON-VOLATILE categories ask the manager of Department 3243 for the analyst's name responsible for the samples in question. Locate the analyst and his instrument logbook to verify if sample is analyzed.

3.2.2.2 For the GCMS, TECHNICON, MERCURY and WATER QUALITY categories check the instrument logbooks to find the desired samples. If the logbook is not located by the instrument or in its designated location, ask the analysts or group leaders to help locate the book. In the Water Quality and Atmospheric Chemistry Department, strip charts of certain analyses may be substituted for an instrument

logbook if sample numbers are clearly marked on the chart.

3.2.2.3 The GC VOLATILE department writes the analysis date of all samples to be analyzed on a wall chart in the technicians' office. If the date is not reported on the chart proceed to the instrument logbooks to check for samples that are analyzed.

3.2.3 DO NOT take anyone's word that the samples being checked are extracted or analyzed. The sample number always has to be clearly marked in a notebook, stripchart or chromatograph for proof that its extraction or analysis is completed.

3.3 **Notification of sample's status**

3.3.1 If a sample has not been extracted or analyzed yet and it has one day or less remaining (three days or less if Friday) on its EPA holding time, fill out an Analysis/Extraction Holding Time notice (exhibit 1). The notice should be project and department specific however it may contain the same samples but requested for different analyses. Different field groups may also be placed on the notice that have the same analysis.

3.3.2 Deliver 1 copy to the following:

3.3.2.1 Department manager

3.3.2.2 Project lab coordinator

3.3.2.3 Group leader (optional)

3.3.2.4 Information Services' files

## E.5

## Automated GCMS Unknown Processing

# AUTOMATED GCMS UNKNOWN PROCESSING SOP

## 1.0 Objectives

The objective for this standard operating procedure is to transfer unknown compounds for a USATHAMA sample from a DOS file to the validation file.

## 2.0 Scope

All unknowns found for samples analyzed by a HP GCMS instrument for USATHAMA methods LM18 and UM18.

## 3.0 Procedures

3.1 The analyst notifies Information Services that a particular USATHAMA lot of unknowns has been transferred to I:\TEMP with the filename, a hard copy of the file and the GCMS library search.

3.2 The data analyst then activates the Unknown Report program located in the CLASS menu option USATHAMA.

3.3 After typing in the directory and filename, the data analyst is prompted to enter the output filename which is "filename.UNK".

3.4 Enter the method code, LM18 or UM18. The data analyst is then asked for two numbers. If LM18 method, type "90". If UM18 method, type "91". In the next window enter the Add.Factor "500". The program will then finish uninterrupted.

3.5 Print out a hard copy of the output file to the laser printer.

3.6 Check the output file to see if there are any errors such as improper method blank correction or USATHAMA identified compounds without a test name that have a CAS number. If there are errors, fix them

accordingly and rerun the program again overwriting the existing output file until the file is correct.

3.7 Make three copies of the output file. File one copy. Give one copy to the analyst and also give one to the lab coordinator. Put the original copy along with the documents the analyst gave information services with the correct USATHAMA lot folder.

3.8 Merge the unknown file with the validation file using the Batch Results Merge program located under the CLASS menu option Lab Data. Following the step-by-step process and calling the new file "lot.UNK", print out the new merged validation file.

3.9 After reviewing the new validation file, stamp and label it correctly. Then place it in the USATHAMA lot folder along with all of the other documents.

3.10 Return the lot folder to the validation chain after designating on the lot folder's cover sheet that the unknowns have been merged into the validation file.

E.6

GCMS Upload Files

# GCMS UPLOAD FILES SOP

## 1.0 Objectives

The objective of this standard operating procedure is process a GCMS upload file to data batch.

## 2.0 Scope

All samples run by GCMS must be uploaded into a CLASS data batch so data is obtainable to the CLASS data base.

## 3.0 Procedures

3.1 A GCMS Download Request is filled out by the analyst and turned into Information Services when the upload file is transferred to I:\TEMP or a floppy disk.

3.2 The data analyst will then run the file in the Autobatch Program found in the CLASS menu option, Lab Data.

3.3 The data analyst will choose the option "HP" or "FINNIGAN", depending on which instrument type is used by the GCMS department.

3.4 Enter the directory and filename when prompted to do so. At the next window prompt type "NEW" to obtain the new batch designation.

3.5 After the program reads the samples in the file a window prompt will appear requiring some information. Type in the analyst's employee number, the extraction date (semi-volatiles only), data analyst's employee number, the method code and into the comments section, the upload file name. Save this information by hitting the F9 key.

3.6 The program will automatically complete it's process if no errors are encountered.

3.7 If errors occur, then take the appropriate actions to fix these errors and then rerun the batch through the upload process again. Instead of typing "NEW" at the correct prompt type the orginal batch number. This will create a safety prompt where the data analyst can either get out of the upload program or continue by typing "RERUN". Continue through all of the steps until the download process finishes completly error free.

3.8 Run the data batch through Batch Results and return to analyst.

3.9 Document the upload process on that week's GCMS Data Transfer form.

E.7

Usathama Lot Folder Assignment

# USATHAMA LOT FOLDER ASSIGNMENT SOP

## 1.0 Objective

The objective of this standard operating procedure is to generate a new lot folder for a unique analysis run of an USATHAMA method.

## 2.0 Scope

A USATHAMA lot folder is assigned for all samples belonging to a USATHAMA project.

## 3.0 Procedures

3.1 A USATHAMA lot folder is initiated when an analyst/extractor brings a request for set of USATHAMA samples being analyzed or extracted. This request must include the samples, USATHAMA method and analyst/extractor's initials.

3.2 The next available three-letter coded lot for that particular method is assigned by looking into the Lot Assignment Document Book. If that series of three-letter codes are completed, start a new series of three-letter codes (i.e. lot series XXA through XXZ).

3.3 Determine the earliest sample collection date of the group of samples.

3.4 Assign the next incremented method blank for that particular USATHAMA project and analysis method.

3.5 Record all of this information into the Lot Assignment Document Book.

3.6 Select the appropriate colored lot folder based on the department the method is run under. Apply USATHAMA ANALYTICAL LOT/FOLDER TRANSMITTAL FORM to the lot folder. Fill out all the information in

the spaces provided on the form. The Level II Due Date is forty days from the earliest collection date.

3.7 Place the proper documents into the lot folder that need to be filled out by the personnel involved with the processing of this lot folder. These documents may include:

3.7.1 USATHAMA Data Review Checklist

3.7.2 Extraction Data Sheet

3.7.3 Final Checkoff List Prior To Transmission of USATHAMA Lot Data

3.7.4 Comment/Corrective Action Form for Control Charts

3.7.5 Table of Contents label

3.7.6 Army Data Review Form

3.8 Deliver folder to the analyst/extractor who requested.the lot folder.

3.9 Enter lot into CHEMTRAK.

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# USAEC STANDARD OPERATING PROCEDURE FOR DATA VALIDATION

# DATA VALIDATION STANDING OPERATING PROCEDURE

1. Data validation shall be performed during routine analyses (e.g., weekly quality control (QC) chart review), during laboratory audits, following receipt of electronic data at Potomac Research, Inc. (PRI), and following receipt of hard copy data packages at the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA). The purpose of data validation is to compare to quality of the data generated by the laboratory with the Data Quality Objectives as stated in each QAPjP.

2. Frequency of Validation:

a. QC Chart Review - Shall be performed weekly, following receipt of control charts for analyses performed the previous week.

b. Laboratory Audit - Approximately 20 percent of all lots for which the data packages have not yet been forwarded to USATHAMA, with a minimum of two lots from each active certified method shall be selected and examined during the audit. For those methods which have been identified as having control problems (see paragraph 3) the frequency of inspection should be increased.

c. At USATHAMA following receipt of electronic data: All lots received at PRI shall be reviewed for useability.

d. At USATHAMA following receipt of hard copy data packages: Data packages are received grouped as delivery orders or task orders. Approximately 20 percent of all lots, with a minimum of two lots per method shall be selected from each delivery order. In addition, at least one method per delivery order shall be chosen for a 100 percent audit of data packages. If lots have been identified as having control problems (see paragraph 3), this review should concentrate on these lots.

3. Weekly QC Chart Reviews: The contractor laboratories are required to generate and review daily QC charts for each day that analyses are performed. These charts are then forwarded weekly to USATHAMA for review by a USATHAMA chemist. Review shall consist of assessing trends, cycles, patterns, etc. This review shall also ensure that control problems have been correctly addressed by the laboratory and that appropriate corrective actions have been implemented. A letter detailing the results of this review is forwarded to the contractor laboratory for additional corrective actions (if necessary), with a copy to be placed in the QC chart file.

4. Laboratory Audit:

a. Validation shall include, but is not limited to, the following items:

(1) Examination of chain-of-custody records to ensure that custody was properly maintained.

(2) Comparison of data on instrument printouts with data recorded on work sheets or in notebooks.

(3) Comparison of calibration and analysis dates. Also checking to ensure that the same calibration was used for all samples within a lot.

(4) Examination of chromatographic outputs for manual integrations, and documentation of the reasons for any manual integrations.

(5) Comparison of standard and sample preparation records and injection records, with instrument output to ensure that each output is associated with the correct sample.

(6) Examination of calibration and tuning requirements, as specified in the methods, to ensure compliance with the USATHAMA Quality Assurance Program.

(7) Using a hand-held calculator perform all calculations on selected samples to ensure correctness of results.

(8) Ensure that GC/MS library searches have been performed for all unknowns and that the results have been evaluated and recorded.

(9) Examination of all papers and notebooks to ensure that all pages are signed and dated, that all changes are initialed, dated, have sufficient explanation for the change, and that all items are legible.

(10) Comparison of transfer file, record and group check results with analyses results as recorded in the data package.

(11) Procure copies of selected methods as used in the laboratory, for comparison with certified method writeup maintained at USATHAMA. This comparison is performed after the audit team returns to USATHAMA.

(12) If time permits, a magnetic tape of GC/MS output should be selected and the output data on the tape shall be recreated. This output shall be compared to the hard copy output on file.

b. Record keeping required following a laboratory audit:

Record all lots which were reviewed in the audit report. Also identify in the audit report any deficiencies which were noted. A copy of the audit report shall be placed in the applicable installation audit folders.

5. Review Following Receipt of Electronic Data at PRI:

a. Validation shall include, but is not limited to, the following items:

(1) Results of control chart review (see paragraph 3).

(2) Review of surrogate/standard addition recoveries.

(3) Review of results from record and group check, with particular attention to holding times, required control spikes, and spike levels.

(4) Review results of all method blanks, control spikes, trip blanks, and rinse blanks.

b. Record keeping required following review of data received by PRI:

Prepare a report on the useability of the data based on the review items noted in subparagraph 4a above, using THAMA Form Z. Forward two copies of report to the project officer in the Installation Restoration Division (IRD), Base Closure Division (BCD), and Environmental Compliance Division (ECD). Project officer shall forward one copy to the installation or A&E firm producing the project report. In addition, any errors or problems shall be noted through the use of Installation Restoration Data Management System (IRDMS) flagging codes (see Appendix A).

6. Review Following Receipt of Hard Copy Data Packages at USATHAMA:

a. Validation shall include, but is not limited to, all items in paragraph 4, with the exception of items 11 and 12.

b. Record keeping required following review of hard copy data packages:

Record any deficiencies on THAMA Form Y and place in the front of the data package. For each record box, summarize the deficiencies on THAMA Form X and tape this form to the outside of the box. Prepare a letter summarizing all deficiencies in the delivery order or task order. Forward this letter (via the Contracting Officer's Representative) to the laboratory which performed the analyses. Any subsequent corrective actions should also be recorded on THAMA Form Y. If this review changes the useability of the data, forward two copies of this information to the project officer at IRD/BCD/ECD, using THAMA Form Z. Project officer shall forward one copy to the installation or A&E firm producing the project report. Also, if required, changes must be made to the IRDMS flagging codes (see Appendix A).

7. Final Project Report: The final project report produced by the installation or A&E firm shall be reviewed to ensure the correct data useability statements have been included in the report.

# USATHAMA DATA PACKAGE REVIEW

THIS DATA PACKAGE FOR ______________, ______ HAS BEEN REVIEWED.
INSTALLATION LOT

THE FOLLOWING DEFICIENCIES ARE NOTED (IF NONE, STATE NONE):

REVIEWERS SIGNATURE ______________ DATE ______________

LABORATORY REQUESTED TO CORRECT DEFICIENCIES ON ______ BY ______
DATE INITIALS

CORRECTIONS RECEIVED AND APPROVED: ______ ______
DATE INITIALS

THAMA FORM Y

INSTRUCTIONS FOR USE:

1. Use one form for each analytical lot.
2. Any problems potentially affecting data quality should be noted under the appropriate heading(s). Also note sample sites and/or analytes affected by each problem.
3. Enter the appropriate flagging code (where applicable) into IRDMS.

A. CONTROL CHART PROBLEMS

1. Low recoveries, possible false negatives. (Flagging Code = I)

2. High recoveries, possible false positives. (Flagging Code = H)

3. Other control problems (missing control spikes, incorrect spike levels, trends, cycles, etc.).

B. PROBLEMS WITH SURROGATES/STANDARD ADDITIONS. (Flagging Code = Q)

1. High recoveries, possible positive matrix effect.

2. Low recoveries, possible negative matrix effect.

3. Surrogates/standard additions not performed correctly.

C. CONTAMINATION IN BLANKS (Flagging Code = B)

1. Method blank.

2. Trip blank (VOA only).

3. Rinse blank.

D. HOLDING TIMES EXCEEDED.

1. Projected minor impact to data quality. (Flagging Codes = J, K, L)

2. Projected major impact to data quality. (Method 99)

E. OTHER ANALYTICAL PROBLEMS (specify)

F. DEFECTIVE CHAIN-OF-CUSTODY

G. Did the data in this lot meet the data quality objectives?

Yes___ No___

If not, identify which samples in this lot did not meet the DQOs.

Reviewer________________________________ Date____________

# 8.08 Flagging Code

## ELEMENT IS USED IN THE FOLLOWING IR RECORDS AND DATA BASE TABLES:

| IRDMIS Record | | IRDMIS Data Base | |
|---|---|---|---|
| Record Type | Column(s) | DB Table(s) | DB Column |
| • | 132 | chem/cqc | flag_codes |
| | 133 | | |
| | 134 | | |
| | 135 | | |
| | 136 | | |
| | 137 | | |
| | 138 | | |
| | 139 | | |
| | | flag_quals_desc | f_q_code |

• Any valid chemical or radiological record type

## ELEMENT SIZE AND CHARACTERISTICS:

| | | |
|---|---|---|
| IRDMIS Record: | 1 upper-case alphabetical character, full field (as many as 8 per record) | |
| IRDMIS Data Base: | chem/cqc: | as many as 8 Flagging Codes per record |
| | flag_quals_desc: | 1 Flagging Code per record |

## ELEMENT DESCRIPTION:

Code assigned by the Laboratory to indicate other-than-usual analytical conditions or results.

## ACCEPTABLE CRITERIA:

NOTE: **Flagging Codes marked with * were changed effective 1 February 1993!**

* A — Analyte found in trip blank as well as in field samples . The analyte was detected in the field sample and the trip blank for the same cooler. To be used for volatiles only.

B — Analyte found in the method blank or QC blank as well as the sample. This Code is to be used when an analyte was detected and quantitated at higher-than-normal background levels. For metals in soil, the following rules must be followed:

(1) If the analyte is detected in the method blank, both the field and QC samples are to be flagged.
(2) If the analyte is detected in the QC blank, only the QC samples are to be flagged.

C — Analysis was confirmed. This Code is to be used when a confirmatory analysis bears out the reported result (if it is above the CRL or MDL). The confirmatory analysis must use a different column or analytical technique.

D — Duplicate analysis. This Code is used to distinguish analytical results when duplicate analyses are required. Flag only the second (duplicate) sample.

E — **No longer in use.**

## ACCEPTABLE CRITERIA: (CONT.)

F Sample filtered prior to analysis. This Code is to be used when results of filtered samples are to be differentiated from non-filtered samples. This Code is also to be used when filtering of samples (as a first step in the sample preparation) is a deviation from the approved method SOP. This Code may be used to indicate both field and laboratory filtering. It is not to be used when filtering the extract is the normal procedure.

* G Analyte found in rinse blank as well as field sample. The analyte was detected in the field sample as well as that day's rinse blank for the same equipment type.

H Out of control but data accepted due to high recoveries. This Code is to be used when control analytes show higher-than-normal recoveries, assuring USAEC that if a concentration was found in the sample at or near the CRL, it would have been reported.

* I Interferences in sample cause the quantitation and/or identification to be suspect. This Code is to be used when matrix interferences may mask detection of the target analyte. Must always be used with Flagging Code J.

* J Value is estimated either due to interferences in the sample (use Flagging Codes J and I) or because the value is below the method detection level but above the instrumental detection level (use Flagging Codes J and P). This Code must always be used with Code I or P. The J and I combination may be used both for methods demonstrated under the 1990 QA Program and for methods validated under the 1993 QA Guidelines. The J and P combination is only to be used for methods validated under the 1993 QA Guidelines.

* K Reported results affected by interferences or high background. This Code is to be used when analyte levels at or near the CRL or MDL cannot be accurately quantified down to the CRL/MDL due to interferences. This Code will allow a laboratory to input a higher CRL/MDL, rather than defaulting to the Methods data base. **(Formerly Flagging Code G)**

* L Out of control, data rejected due to low recoveries. This Flagging Code is to be used when recoveries of the control analytes are depressed so that there is no assurance that values at or near the CRL are accurate. **(Formerly Flagging Code I)**

M Duplicate (high) spike analysis not within control limits. This Flagging Code is to be used when one of the duplicate spikes gives significantly different results, placing the spike average outside of control limits.

* N Tentatively identified compound (result of a GC/MS library search) with a match greater than 70%. To be used when specified in the contract/task order.

* O **No longer in use.**

## ACCEPTABLE CRITERIA: (CONT.)

| | | |
|---|---|---|
| * | P | Value is less than the method reporting level but greater than the instrumental detection limit. This Code must always be used with J. This Code is only to be used for methods validated under the 1993 QA Guidelines. |
| * | Q | Confirmatory analysis was performed; however, sample interference obscured the area where the peak of interest would have appeared. To be used when the peak of interest fell within the retention-time window on the primary column, but the retention-time window on the secondary column was masked by interferences. |
| | R | Non-target compound analyzed for but not detected (must be used with a Boolean of ND). This Code is used only for those analytes (in GC/MS methods) which were not performance demonstrated or validated. To be used when specified in the contract/task order. |
| | S | Non-target compound analyzed for and detected. This Code is used only for those analytes (in GC/MS methods) which were not performance demonstrated or validated. Also used to report tentatively identified compounds which are quantitated against an internal standard. To be used when specified in the contract/task order. |
| | T | Non-target compound analyzed for but not detected (must be used with a Boolean of ND). This Code is used only for those analytes (in non-GC/MS methods) which were not performance demonstrated or validated. |
| | U | Analysis is unconfirmed. This Code is to be used when a confirmatory analysis was performed but does not verify the analytical results from the initial analysis. |
| | V | Sample was subjected to unusual storage/preservation condition. To be used when samples are received at the laboratory at greater than 4° C, or were not correctly preserved in the field. |
| | W | Single analyte required from a multi-analyte method. This Code is to be used when field samples are to be analyzed for a subset of the demonstrated/validated analytes. |
| | X | Analyte recovery outside of certified range but within acceptable limits. This Flagging Code is to be used when analyte recoveries exceed the upper limit of the certified range by less than 15% and the laboratory feels a dilution is not warranted. |
| * | Y | Tentatively identified compound (result of a GC/MS library search) with a match of less than 70%, but peak area is greater than 35% of the internal standard. To be used when specified in the contract/task order. |
| * | Z | Non-target compound analyzed for and detected. This Code is used only for those analytes (in non-GC/MS methods) which were not performance demonstrated or validated. |

## ACCEPTABLE CRITERIA: (CONT.)

* 1 Result less than the CRL but greater than the Criteria of Detection (COD). Can only be used for methods which were performance demonstrated under the 1990 QA Program.

* 2 Ending calibration not within acceptable limits. This Code is to be used for an analyte for which the ending calibration is still unacceptable after multiple attempts.

* 3 Internal standard(s) not within acceptable limits.

* 7 Low spike recovery is not within control limits. This Code is to be used when the low spike recovery (not the three-day average) falls outside of control limits and the analytical data is potentially biased. **(Formerly Flagging Code N)**

## ACCEPTABLE ENTRIES:

| | |
|---|---|
| * A | Analyte found in trip blank as well as in field samples. |
| B | Analyte found in the method blank or QC blank as well as the sample. |
| C | Analysis was confirmed. |
| D | Duplicate analysis. |
| F | Sample filtered prior to analysis. |
| * G | Analyte found in rinse blank as well as field sample. |
| H | Out of control but data accepted due to high recoveries. |
| * I | Interferences in sample make quantitation and/or identification to be suspect. |
| * J | Value is estimated. |
| * K | Reported results are affected by interferences or high background. |
| * L | Out of control, data rejected due to low recoveries. |
| M | Duplicate (high) spike analysis not within control limits. |
| * N | Tentatively identified compound (match greater than 70%). |
| * P | Results less than reporting limit but greater than instrumental detection limit. |
| * Q | Sample interference obscured peak of interest. |
| R | Non-target compound analyzed for but not detected (GC/MS methods). |
| S | Non-target compound analyzed for and detected (GC/MS methods). |
| T | Non-target compound analyzed for but not detected (non-GC/MS methods). |
| U | Analysis is unconfirmed. |
| V | Sample subjected to unusual storage/preservation conditions. |
| W | Single analyte required from a multi-analyte method. |
| X | Analyte recovery outside of certified range but within acceptable limits. |
| * Y | Tentatively identified compound (match less than 70%). |
| * Z | Non-target compound analyzed for and detected (non-GC/MS methods). |
| * 1 | Result less than CRL but greater than COD. |
| * 2 | Ending calibration not within acceptable limits. |
| * 3 | Internal standard(s) not within acceptable limits. |
| * 7 | Low spike recovery is not within control limits. |

# DATA PACKAGE REVIEW

THE FOLLOWING DATA PACKAGES IN THIS BOX HAVE BEEN REVIEWED:

| INSTALLATION | LOT | DATE | REVIEWER | COMMENT |
|---|---|---|---|---|
| | | | | |

THAMA FORM X